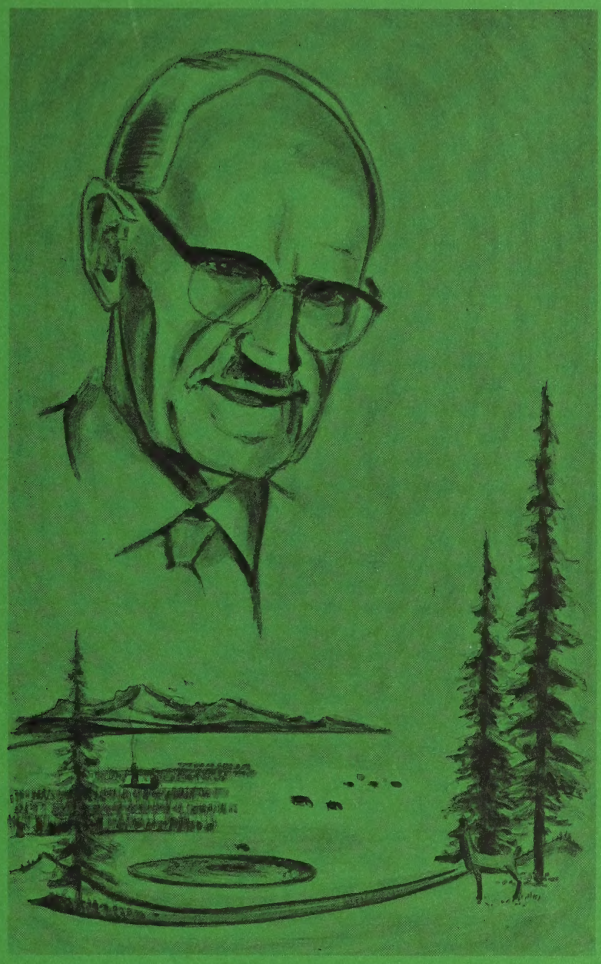
FIVE IS ONE



21st

ALBERTA 4-H CONSERVATION CAMP

SILVER CREEK RANCH, WATER VALLEY

JULY 20 - JULY 26, 1986

COVER

The theme of the camp, "Five is One", and the scene on the cover, represents the concept that a true conservationist is concerned with the uniqueness and interdependence of soil, water, forest, range, and fish and wildlife. Dr. Grant MacEwan, whose portrait appears on the cover, is synonymous with conservation awareness. His outstanding contributions to mankind as a conservationist led to the introduction, in 1975 (the 10th anniversary of the Camp), of the Grant MacEwan Conservation Award.

This award, a sculptured plaque of the scene on the cover, will be annually presented to a graduate 4-H camper in recognition of personal effort in spreading the conservation message.

Like the Grant MacEwan Conservation Award, this camp is sponsored by TransAlta Utilities Corporation and Alberta Power Limited, and administered by the 4-H Branch, Alberta Agriculture.

Sponsored by:

TransAlta Utilities Corporation
Alberta Power Limited

Working in co-operation with the
4-H Branch, Alberta Agriculture

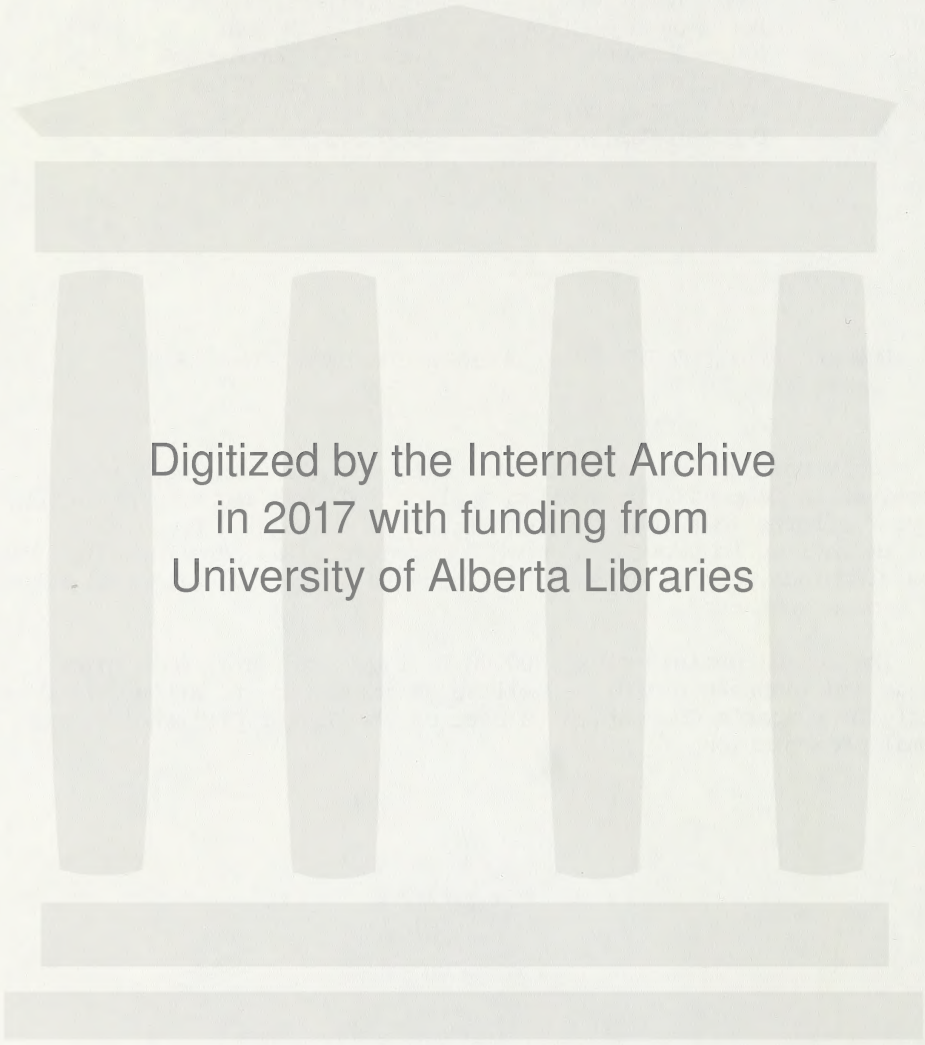
PREVIOUS GRANT MACEWAN AWARD WINNERS

1985	Ann Marie Trenson	Box 421, Rimbey
1984	Shane Bateman	R.R.#2, Calgary
1983	(Award not presented)	
1982	Heather Jackson	Box 2, Site 7, R.R.#8, Calgary
1981	Karen Hebson	R.R.#2, Okotoks
1980	Janis Kendrick	R.R.#1, Pickardville
1979	Bette-Jean McElroy	Box 127, Hussar
1978	Helen Schwenk	Box 386, Coronation
1977	Francis Lema	R.R.#1, St. Albert
1976	Holli Berringer	Box 456, Milk River
1975	Deborah Sapiuk	Vegreville

HOW TO APPLY FOR THE GRANT MACEWAN CONSERVATION AWARD

Early next spring, all Alberta delegates attending this year's Conservation Camp will be sent an application form requesting details of your efforts to spread the 'conservation message'. Applicants will be invited to provide as much documentation as possible, including news clippings, copies of speeches, details of special projects undertaken, and groups contacted.

The award consists of a $200.00 Savings Bond, a large engraved plaque and keepsake award, as well as an invitation to attend the Alberta Weekly Newspaper's Convention as part of the Junior Citizens' Banquet for formal presentation.



INDEX

IN THE END there was earth, and it was with form and beauty.

And Man dwelt upon the lands of the earth, the meadows and the trees, and he said, "Let us build our dwellings in the place of beauty;" and he built cities and covered the earth with concrete and steel. And the meadows were gone. And man said, "It is good."

On the second day, man looked upon the waters of the earth. And man said, "Let us put our wastes in the water that the dirt may be washed away." And man did. And the waters became polluted and foul in their smell. And man said, "It is good."

On the third day, man looked upon the forests of the earth and saw they were beautiful. And man said, "Let us cut the timber for our homes and grind the wood for our use." And man did. And the lands became barren and the trees were gone. And man said, "It is good."

On the fourth day, man saw that animals were in abundance, and ran in the fields and played in the sun. And man said, "Let us cage these animals for our amusement and kill them for our sport." And man did. And there were no more animals on the face of the earth. And man said, "It is good."

On the fifth day, man breathed the air of the earth. And man said, "Let us dispose of our wastes into the air for the winds shall blow them away." And man did. And the air became filled with the smoke and the fumes could not be blown away. And the air became heavy with dust and choked and burned. And man said, "It is good."

On the sixth day, man saw himself; and seeing the many languages and tongues, he feared and hated. And man said, "Let us build great machines and destroy these, lest they destroy us." And man built great machines and the earth was filled with the rage of great wars. And man said, "It is good."

On the seventh day, man rested from his labors, and the earth was still - for man no longer dwelt upon the earth.

And it was good.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

This article was written by an American student, Kenneth Ross - a tail-piece to the creation story in the book of Genesis.

CONSERVATION AND AVAILABLE RESOURCES

The destruction of our resources is a concern expressed on every tongue. We hear constantly of the destruction of resources. The people working on these concerns are conservationists. Their concern is really only beginning the conservation movement.

What, then, is conservation? Conservation is a way of life, a thought process, a concern for the future. Conservation in its fullest sense is not preservation for future use, but rather wise management for present use and renewal for the future. By management, we mean providing necessary controls and preservation steps to ensure that our great renewable resources are not lost. Thus conservation is really a way of life, using and returning resources for future use. These basic renewable resources are air, water, soil, plant and animal life.

If we are going to be able to offer future generations the opportunities we now have to enjoy nature and life, we must make sure the loss of these resources doesn't continue as it has during our lifetime.

How can this be done? Only through making individuals aware of resources at hand. This is what conservation camp is all about. The five areas within conservation are presented and discussed in terms of their interrelationship and interdependence. The secret of the balance of nature lies within these five areas of concern.

Man has been the greatest despoiler of our resources, but only he has the power to check this destruction and bring about the restoration and renewal required.

You as a student of conservation can take a front line position in fighting to save tomorrow for yourselves and your children. It is only through individual concern and pressure that one can achieve real results.

The individual concern can only be developed through learning conservation awareness. Our sponsors feel that the greatest results can be achieved through young people. In providing this opportunity, they are seeking to assist concerned youth in gaining knowledge about conservation.

This information will assist young people in more capably telling the conservation message. As well, the camp strives to give guidance in indicating and taking the action required, to guarantee our resources for the future.

Here are five steps you can take in the Conservation Battle:

1. Learn the facts and what is being done about conservation in your area. Tell others.

2. Support and push for laws and bylaws concerning conservation.

3. Support the construction of adequate sewage and garbage disposal facilities.

4. Encourage local industries in their efforts to clean up their own waste.

5. Take an active part in getting behind conservation groups and other concerned organizations in fighting for the future.

The following is a list of some places where you may be able to obtain visual aid equipment. The policy regarding the use of equipment varies greatly from area to area, but these are sources you should check out:

- Schools
- Alberta Environment
- Alberta Recreation and Parks
- Alberta Agriculture
- County Offices
- Public Relations representatives for larger companies
- Forest Superintendents' Offices

In your local communities, the following are individuals or organizations which may be contacted regarding possible speaking engagements on conservation. Many of these individuals may be interested in conservation as well and may be able to give assistance and guidance in working in your community.

- Local radio, T.V. stations - interviews, publicity
- Newspaper editor - articles and publicity, stories
- Civic Officials - Mayor, Town secretaries - leads regarding speaking engagements and service clubs in town
- Service Clubs - Lions, Kinsmen, Rotary, etc., - speaking engagements, local activity groups
- Local Fish & Game Association - conservation-oriented individuals; possible speaking engagements
- Fish & Wildlife Officers - concerned conservationists working in your area

- Utilities Company Managers - TransAlta Utilities Corporation, Alberta Power Limited - interested sponsor representatives

- District Agriculturists

- Foresters and Forest Rangers

ADDITIONAL RESOURCE CONTACTS

Environment Council of Alberta Library
8th. Floor, Weber Centre
5555 Calgary Trail
Edmonton, Alberta
T6H 5P9

Alberta Municipal Affairs Library
9th. Floor, Jarvis Building
9925 - 107 Street
Edmonton, Alberta
T5K 2H9

Alberta Energy & Natural Resources
Information Centre
lst. Floor, Bramalea Building
9920 - 108 Street
Edmonton, Alberta
T5K 2M4

Agriculture Canada
Information Division
Ottawa, Ontario
KlA 0C7

Distribution Services, Alberta Bureau of Surveying and Mapping
Alberta Energy & Natural Resources
2nd. Floor, North Tower
Petroleum Plaza
9945-108 Street
Edmonton, Alberta T5K 2G6

Wildlife Branch, Fish & Wildlife Divis
Alberta Energy and Natural Resources
5th. Floor, Bramalea Building
9920 - 108 Street
Edmonton, Alberta T5K 2M4

Alberta Agriculture, Print Media Branc
7000 - 113 Street
Edmonton, Alberta
T6H 5T6

Many of the above addresses, plus additional contacts and information, are published in the "Natural Resources Information Directory". Copies of the Directory can be obtained from:

Distribution Services
Alberta Bureau of Surveying & Mapping
Alberta Energy & Natural Resources
2nd. Floor, North Tower
Petroleum Plaza
9945 - 108 Street
Edmonton, Alberta T5K 2G6
Telephone: 427-3520

Alberta Energy & Natural Resources
Information Centre
lst. Floor, Bramalea Building
9920 - 108 Street
Edmonton, Alberta
T5K 2M4
Telephone: 427-3590

SUGGESTED FILMS FOR CONSERVATION

1. BEHIND THE SWITCH - THE ELECTRIC WAY
2. BEHIND THE SWITCH - FROM COAL TO KILOWATTS

Available from: Public Affairs
TransAlta Utilities Corp.
Room 801, Box 1900
Calgary, Alberta
OR
Public Relations Department
Alberta Power Limited
Box 2426
Edmonton, Alberta

3. THREE RIVERS
4. WATER (UN Version)
5. MAN THE POLLUTER
6. THE CLIMATES OF NORTH AMERICA
7. RIVER WITH A PROBLEM

Available form: National Film Board of Canada
10031 - 103 Avenue
Edmonton, Alberta

8. MORE FROM THE LAND
9. GROUND WATER
10. SOILS - A TALE OF TILLAGE
11. MORE PASTURE FOR MORE MONTHS
12. THE FOREST WATCHERS
13. ANOTHER SIDE OF THE FOREST
14. THE FOREST IN CRISIS
15. OH GULLY - WHERE IS THE SOIL

Available from: Agriculture Film Library
7000 - 113 Street
Edmonton, Alberta

16. BEARGRASS CREEK
17. THE CHOICE IS YOURS
18. NATURE's PLAN
19. SOLILOQUY OF A RIVER

Available from: Alberta Government Services
Public Affairs Bureau
Provincial Film Library
11510 Kingsway Avenue
Edmonton, Alberta

SUGGESTED SLIDES FOR CONSERVATION

1. THE REGRASSING STORY
2. WATER EROSION
3. WIND EROSION

Available from: Agriculture Film Library
7000 - 113 Street
Edmonton, Alberta

SUGGESTED VIDEOS FOR CONSERVATION

1. LAND REBORN

Available from: BC Department of Agriculture

A GUIDE TO TELLING OTHERS

To be exposed to new and valuable information, and made the wiser for it, is a wonderful thing. But to keep that new-found wisdom to yourself is wasteful. It is a fact of life that pollution results from people. Conservation is a conscious effort to offset, and hopefully eliminate, pollution. People are not about to be eliminated, but they can be made more aware of what they can do to help conservation efforts.

This section of your manual is designed to assist you in taking the knowledge you have gained and applying it to people in a variety of possible ways in hopes that more people become more conscious of their environment.

1. SPEAKING IN PUBLIC

Giving a speech is simply the art of good conversation presented in a specific way. All of us practice conversation every day in chatting with our friends or conferring with our families. Consequently, we already possess the fundamental skills. We speak naturally, directly, and spontaneously. If there is an idea to express, we try to present it clearly and logically to everyone present.

When speaking to an audience, all of these principles of good conversation are followed. In addition, words must be chosen more carefully than in casual conversation and spoken loudly enough for everyone to hear.

The first requirement of speech-making is, of course, to have something to say. Before you prepare a talk for a group, note the following details:

WHEN - date and time

WHERE - place, size, furniture (platform, microphone)

WHAT - purpose of inviting you/what message do you want to leave with your audience?

WHO - audience, number, interests and/or occupations

HOW LONG - time limit

The primary question one asks is - What special knowledge or experience have I to pass along to these particular people? You, of course, will be speaking on some aspect of conservation, but decide in advance what you want to emphasize. Now you will want to decide whether your talk is going to be:

INSPIRATIONAL	INFORMATIVE
PERSUASIVE	ENTERTAINING

Unless you set a target for yourself, and establish some way in which you want your audience to react, your speech will lack vitality. The topic must be something you feel confident in discussing and it should be of interest to you personally. Your enthusiasm will reflect on your audience.

2. SLIDES

Using slides to supplement a talk is a very effective way to communicate information. Your audience will retain more because you appeal to more than one sense. (i.e. they see as well as hear your message).

Familiarize yourself in advance with the slides you will use. A written commentary is supplied in this manual for each of the study areas. You may wish to alter the slide series and commentary depending upon what you want to emphasize in any particularly presentation.

If possible, check in advance to ensure that the projector is in working order and that your slides are loaded so as to project correctly on the screen. Place the screen so that everyone has a clear view. The physical set-up of the room, darkness, chairs, etc. should be considered. When you are ready to show a set of slides, you should be able to tell your audience in one sentence what they are going to see and why they are going to see it.

Generally it is better to have too few than too many slides. A 20 - 30 minute slide talk usually contains 15 - 40 slides. Screen individual slides long enough to allow people to determine the message, but not so long that their attention has time to wander. Three seconds is rather fast and 90 seconds is usually too long for one slide to be projected.

Because your picture will tell some of the story, your words should be brief, interesting and to the point. Don't repeat what the pictures clearly show but develop the story from what is already understood. Whatever is said should be said about the picture that is being seen; try not to use it to give a talk on something else.

3. NEWSPAPERS

There are three basic types of newspaper articles:

- the news story
- the editorial
- the feature story

There are distinct differences between the three types of articles, and each is suited to presenting a particular type of information.

The news story is an impersonal presentation of the facts in a structured manner--the writer does not present his or her own views and opinions in a news story.

An editorial, on the other hand, is an article which is written specifically to express the writer's opinions or views on a particular subject.

The feature story can contain both facts and opinions, and usually contains a more personal style of writing than the news story. The feature story can be used to describe an experience, and can include the writer's reactions and feelings to the subject being written about. For this reason, you may find that the feature story is most suitable for communicating your experiences at the camp.

Feature articles can be written in simple story style. News articles, on the other hand, are prepared in a very specific "inverted" format, with the climax at the beginning instead of the end. The most important information is presented first, and the least important last. New stories are written in this manner for two reasons. The average reader often does not read all the information in a newspaper, and wants to get the important facts by reading the first few lines or paragraphs of each news story. Also, when the editor is preparing the news pages, there may not be enough space for all the information available, so it may be necessary for him or her to cut some paragraphs from the end of one or more news stories.

LEAD

Most important or unusual feature

BODY

Next in Importance
Lesser Importance
but necessary
incidental

TAIL

Interesting
but not
essential
to news
value

This follows along with the form used in writing or presenting a speech in that there is an introduction, a body and a conclusion. However, these are slightly changed in what is emphasized where:

TITLE - Like the Introduction, outlines the most important feature of the article.

LEAD - "The Lead" is a newspaper term which means that facts are presented next. Here is where you put the all-inclusive FIVE "W's".

WHO - Person
WHAT - Event
WHEN - Time
WHERE - Place
WHY - Reason

The order of appearance of the Five "W's" is varied by the news value of each. An example of this is a club achievement day. Here the event of "What" is the most important and should be discussed first. A club reunion would place "why" at the top of the list, etc.

BODY - The body is where youe expand on what was presented in the "Lead". Here the interesting and incidental material is presented.

TAIL - As you know, newspapers are faced with the problem of spacing. The "Tail" is a unique newspaper device in that it gives the editor a chance to manipulate any news item. Where he is crowded for space, he can drop off the last few lines and not spoil the report. The tail is the natural outcome of what you have presented in the body "but is not essential in news value".

How to Write

Your most important duty is to supply the reader with NEWS and then to have this news read by as many people as possible.

Here are some newspaper "essentials".

- Accuracy is very important - names, dates, spelling

- Reporting is always written in the third person (they, it)

- Use simple language. Use few technical words if possible. Explain them if they are needed as part of your story. Words with fewer syllables are more easily read and understood.

- Try not to use cliched or worn-out phrases such as "by the way".

- Expand your vocabulary - try reading and using a dictionary. Repeating words and phrases should be avoided. Some expressions, such as "lovely" and "awful" are over-used.

- Short sentences are important. Small mouthfuls are more easily digested. The reader's time is wasted if he has to return too often to the beginning of a sentence for its meaning. Here again, judgement is needed. The longer sentences provide variety and prevent you from writing articles that sound abrupt and unfriendly.

- Use short paragraphs. Lead your reader along step by step, rather than letting him struggle through a long, blank-looking paragraph. Remember, too, that a paragraph looks much longer in a narrow newspaper column than it does on a typewritten sheet.

- Use some of the same principles in newswriting as in speaking. Arouse attention and hold attention by making your message as interesting as possible to your readers. What is easy reading is usually hard writing so take your time.

- Allow time for revision. The time to revise is once you have written your message down. Are your words, phrases and meaning clear? Take out unneeded repetition, but leave enough to make your message easily read and absorbed. Let your story be straight, simple and to the point. Winston Churchill said, "There is no such thing as good writing, only good re-writing".

- Remember, "practice makes perfect," and that is as true of writing as it is of other forms of endeavor. Another helpful hint is to look around. You can learn much more from others. When you are reading, it's good to do a little analyzing and studying to see how others have written their articles. Are they appealing or boring, and why?

- If possible, your reports should be typewritten. Double spacing and lots of margin are good practices, even when you send in a hand-written report. This gives the person who edits (checks) the article space to add or change some of the writing.

SAMPLE

(Your Name
Address
Phone No.)

(Date of Writing)
For Immediate Release

4-H Members Attend Conservation Camp

Sixty young Albertans recently attended the 17th annual 4-H Conservation Camp held at Silver Creek Ranch near Water Valley.

The six-day camp is co-sponsored by TransAlta Utilities Ltd., and Alberta Power Limited.

The two electric utilities work in co-operation with the 4-H Branch of the Alberta Agriculture, Alberta Energy and Natural Resources, Alberta Environment and Olds College.

The theme of this year's camp was "Five in One" with the five study areas: soil conservation, water conservation, forest conservation, fish and wildlife management, and range management all encompassed in the general message - conservation.

Each person attending the camp selected two areas of study from among the five and divided his or her time evenly between the two subjects. Lectures, slides and films occupied about one-half of each 4-H camper's study time.

For the graduates of this year's 4-H Conservation Camp, the work is just beginning. Now comes the round of speaking engagements, meetings and film presentations at which campers will attempt to communicate to others in their communities the value of sound conservation practices.

4. RADIO

The radio listener has many distractions, or to put it another way, you have much competition. The audience is not obligated to listen. It's the simplest thing in the world for them to turn you off, even though they may not turn off the radio. If you are doing a district radio talk, try to relate it to your locality and club to give your listener some personal identification.

Tell the listener something in either news information, research information or fresh thinking that will have educational as well as entertaining qualities. Never be caught with half-truths. It is better to have said nothing, than to say it wrong or with ill-founded information.

Clear meaning and well accepted words should form the basis of radio communication. What words? . . . use ear words! In composing and presenting material for broadcast, bear in mind the difference between written and spoken style. If a person is reading a book or newspaper, his eye automatically and almost instantly glances backwards or forward in order to review or absorb. The ear cannot act this way - the spoken word once uttered, is gone forever. For this reason some important points should be remembered:

- Start with an outline
- Gear your talk to the audience in mind.
- Keep sentences reasonably short. Use "I", names, dates, places.
- Remember to enunciate well, using simple conversation language. You would say "don't", "isn't", "he'd be", instead of "do not", "is not", and "he would be".
- Frequent use of questions will add interest and clarity.
- Numbers are good. How much, when, at what address. Identify people by age, things by price, even a date.
- Sometimes, to get a point across, it is best to use popular English as opposed to good English.
- Short familiar words are generally good, "complete" could become "finish", "difficult", "hard", etc.
- Use concrete images as much as possible. "Blue as the sky" is better than "a delicate shade of blue". "As long as your arm" may be more vivid than "two and a half feet".
- Avoid using the same phrase in adjoining sentences, especially to end one sentence and start the next. "There aren't enough 4-H clubs in Canada. In Canada 4-H clubs number 5,500." This is very poor.
- "That" is a word which should not be used on radio. In the sentence, "He said that Saturday was a good day for the club", "that" may be omitted completely.
- A pause is better than an "Ah". Use it occasionally to give the audience a change to absorb your message but be careful not to make it too long.
- Like newspaper writing, the radio uses the "lead". It is your chance to get listening attention. It should say in a nutshell what you are going to talk about and why! Make it interesting, brief and to the point.

The right word in the right place will go a long way. What are you trying to say? Does it mean what you want to to? Judge it further by asking "if someone said that to me, what would I think or conclude"?

When you feel that the talk is satisfactory, have it typed. Double space and underline those words which you wish to emphasize.

Speak in terms and in tones that you would use if you were actually talking face-to-face. This will help you to make your message more personal, more intimate and more convincing.

Much time has gone into preparing your talk, now the real test begins. To be successful, you must sound as if you are talking with assurance, not reading, even when you are. If you have written as you would talk, then you will read this way. To write as you would talk, you may find talking as you write a real help. Also, follow these suggestions:

- Enthusiasm is contagious, so let your eagerness and earnestness come out.
- Avoid giving equal stress to everything. All stress is no stress.
- Group words together and vary the pitch as you do in talking. Avoid a regular, exact delivery.
- Brief introductions are best, with a good parting thought at the end.
- Read your talk several times aloud to discover awkward sound combinations and lack of rhythm. And, of course, you'll check the pronounciation of doubtful words.
- Consult station staff members for advice on radio techniques and tape recorded talks. They're always glad to assist.
- Studios vary, so have a voice test with the controlling engineer.
- Once your distance and angle is established, don't sway back and forth.
- Keep your head up and directly in line with the mike. If you should need to turn away, stop talking until you turn back.
- The best place for the script is beside the mike and in the same plane as the face of the mike.

Remember, the microphone is a friendly ear. So, relax! Smile! Sound eager, with an earnest note and converse!

Good radio interviews are made. They do not "just happen". Responsibility for making it a success rests with both the guest and the person conducting the interview. Some things to remember:

- Talk over the broadcast with the person who is interviewing you if this is possible.
- Some announcers will outline the type of questions that will be asked. When it is impossible to see them in person, telephone or write.
- The questions directed to you will be composed around "how, what, when, where, who or why". The questions should be worded in such a way that it can be answered and should not be answered "yes" or "no". The radio audience wants to hear about you, don't disappoint them.

- As the guest, you will talk in terms of "I, my, and mine".
- Usually, ad lib (talk as one wishes) interviews are best. As the guest you will be guided by your announcer as to topic questions. Speak naturally about the question.

5. Television

The program director edits or runs the show. He is the key person in giving advice, and issuing final arrangements. When in doubt on any particular part of the show, your program director is happy to assist.

With respect to visual aids, these can take any number of forms (posters, snapshots, slides). The type that can be used varies with the equipment a studio possesses. You will be wise to check this. Posters and snapshots are either stapled to a special board or put on a tripod stand. Motion pictures and slide projectors are located in a separate projection room of the television studio. They are mounted in such a way that they can be focused directly into the face of the television camera. The picture from a projection camera is received on still another monitor (or screen) in the control room and cut in as necessary.

The planning and preparation, especially if it is your first appearance, may require a good deal of time. It takes time, if your role is a big one. Be sure of details and rehearse at home.

Personality - The same qualities that make a good public speaker apply to your role and you as a television guest. Friendliness, enthusiasm, sincerity and simplicity.

Talking - Speak in your natural voice. The program director will make suggestions when he tests it on the microphone. Talk more slowly than you normally do. Fast talk on television confuses your audience and hampers learning. Treat the camera as a third person, look at it, and talk to it. When you are being interviewed, speak to the person and look at him. Keep your chin up, don't talk to the floor or table. Avoid answering "Yes" or "No". Try to explain and describe as much as possible.

Dress - Your appearance is very important. Dress should suit the occasion. Avoid horizontal stripes in all part of your apparel because they tend to produce a wavy effect on the screen. Color of clothes may be a factor when a particular background is used. Stay away from pure black or white garments. White reflects light into the camera and black tends to create white lines or "halos" around dark objects. Street makeup is all that is necessary. Be conservative when choosing design and jewellery - this applies to everything from a necktie to a necklace.

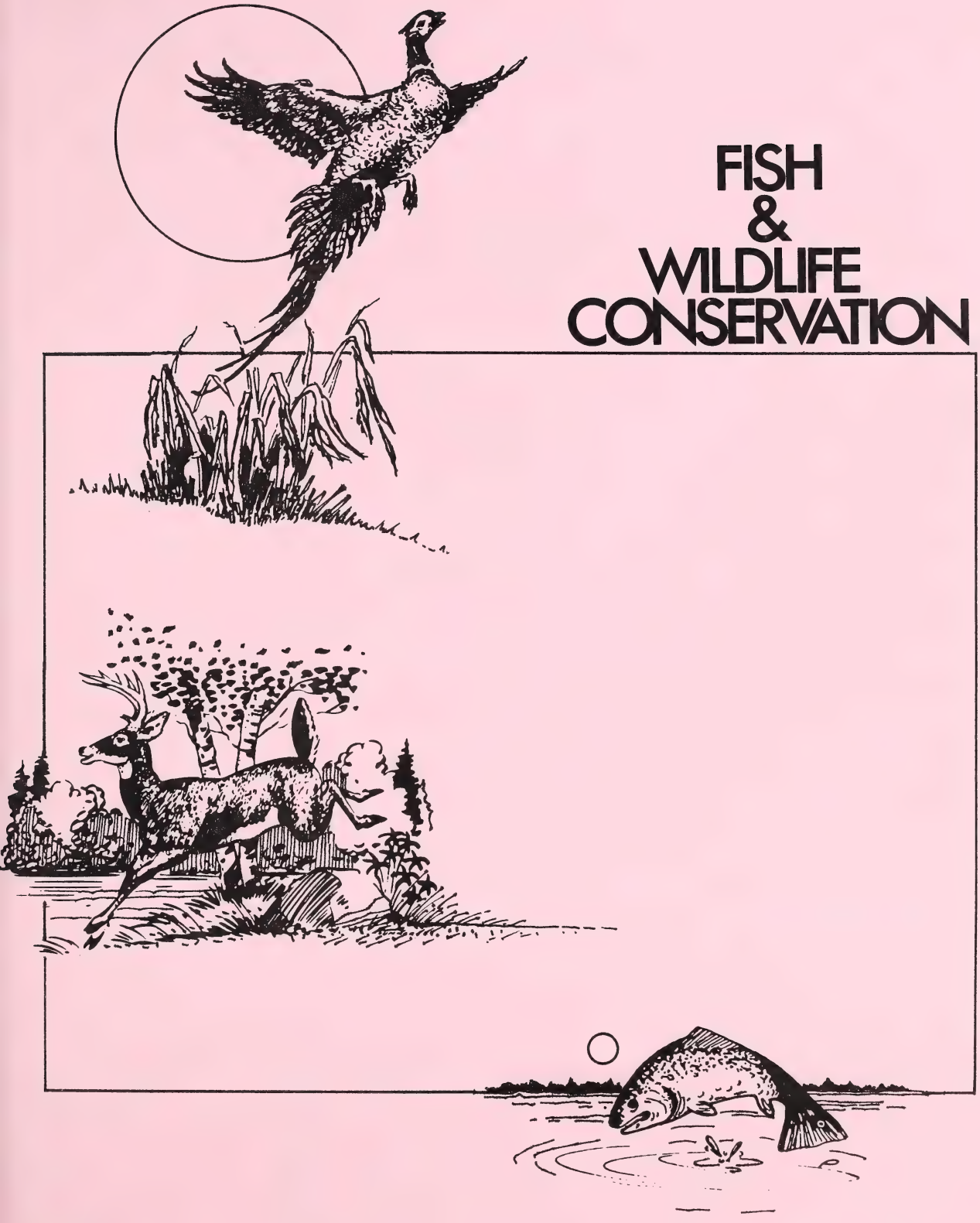
Gestures - Make your movements deliberate, especially during close-ups. All your gestures should remain natural.

Notes - The best procedure is to know your program well enough so that their use is unnecessary, or kept to a minimum. Small cards are better than paper. Make all necessary notations clear and readable.

Television, like films, is an excellent way to show things. A good program strives for 80% visual or seeing, and 20% oral or speaking.

Still pictures are widely used because of their availability and low cost. Studios request special finishes, sizes and mountings. This should be noted in advance. The director will indicate preference to horizontal shots. Usually close-ups are preferred. Occasionally these are handled by you, but most likely they will be put on an easel and picked up by the camera on cue.

Type, color, size and mounting of slides is dictated by the particular studio. When showing slides, a fairly rapid pace is followed. The director will assist you on the timing as it can vary considerably.



FISH & WILDLIFE CONSERVATION

F I S H & W I L D L I F E C O N S E R V A T I O N
I N A L B E R T A

Prepared for:

4-H Conservation Camp

Silver Creek Ranch - 1980

By:

Fish & Wildlife Division

Alberta Department of Energy & Natural Resources

WILDLIFE MANAGEMENT

INTRODUCTION

Everybody likes wildlife of one kind or another.

What is wildlife? The Wildlife Act defines "wildlife" as any non-domestic mammal, bird, reptile or amphibian. In Alberta, fish are not normally considered to be wildlife and are regulated by separate legislation. The "Fish and Wildlife" Division is therefore the title given to the provincial government agency responsible for managing these groups of animals.

Many people, particularly hunters, tend to think of wildlife only in terms of game animals - those species which may be legally hunted and harvested. In Alberta, however, less than 50 of the 500 or more birds and mammals that occur here are classed as game species. The remainder are non-game wildlife species.

"Fur-bearers", some of which are also game animals, are those forms of wildlife that may be taken and used for their fur.

"Predators" are those animals which prey on and use other animals for food.

Some kinds of wildlife are generally considered as undesirable, particularly by farmers or ranchers. These forms are often called "pest" species and may be given little or no protection by the Wildlife Act, the legislation used to govern the use and well-being of wildlife in our Province.

Most other wildlife species are native to Alberta, occurring naturally here before settlers arrived. Some, however, are not native. They have been brought in from another area and introduced here by man. Such non-native, introduced forms of wildlife are often referred to as "exotic species".

Wildlife is a living resource. Living things have a life span and will eventually die to be replaced by others of that kind. Such living animals cannot be "preserved" or saved for future use beyond their normal life span. Living resources can be "conserved" or used wisely. Wildlife conservation is founded on the principles of planned management and wise use.

Wildlife is a valuable renewable natural resource that can be drawn upon and used in a number of ways. Some uses are "consumptive", the individual animal is removed from the population through predation, hunting or trapping and used for food or fur. "Non-consumptive uses" of wildlife, which do not result in removing animals from their population, include such activities as bird-watching, wildlife photography or simply enjoying wildlife through observation.

Throughout history, man has developed a fascination with wildlife as a result of his curiosity about animals and his use of them.

This has been intensified in recent times when most people live in cities and are not in daily contact with wild animals. Most of their knowledge about wildlife comes from T.V., movies, newspapers and books, rather than first-hand contact with living things.

To a degree, most people regard themselves as experts when it comes to wildlife matters - certainly the case with many hunters and fishermen. As a result of this many myths have arisen.

However, the science of ecology has dispelled many of these myths and scientists are continually shedding new light on how wild animals and plants interrelate to man and other aspects of their environment. This field of study is called ecology.

BASIC PRINCIPLES OF ECOLOGY

In the world around us, the living organisms or communities and the non-living environment function together and interact as an ecological system or ecosystem.

Habitat

Within an ecosystem the kind of "home" or habitat a species of wildlife lives in must provide everything it needs to survive - places for feeding, drinking, resting, breeding and escaping danger.

Habitat is the total environment that supplies everything the animal needs - food, cover, air, water and space. When these habitat factors are in good supply, they contribute to the well-being of wildlife. If any component of habitat is in short supply, it limits the number and distribution of wildlife and is called a limiting factor.

Habitat Change

Habitat, the complex association of soil, water and plants is in itself dynamic and ever changing. These changes can be subtle or dramatic. A forest fire causes a dramatic habitat change. The coniferous forest, cool and shady, disappears. Eventually, on the blackened, but now sunlit ground, fireweed, grasses and other plants appear. Each type of plant appears, grows, matures, and disappears to be replaced by others which also go through their stages and are replaced by still other varieties. This series of changes taking place is not random or haphazard but a predictable, sequential chain of events called succession. Each stage of plant life is succeeded by another. At each successional stage, changes in the plant component of the habitat complex alter that complex in total. With each change, be it subtle or dramatic, habitat is changed. With changes in habitat come changes in the forms of wildlife using that particular habitat.

The coniferous forest, burned over, is replaced by a low ground cover of grass and flowering plants. Over the next few years shrubs, bushes, willows, aspens and coniferous trees each in turn, make their appearance. Finally the forest is once again as it was, composed almost entirely of coniferous trees. This final or climax stage will remain until, as a result of fire or logging, the successional cycle is triggered once again.

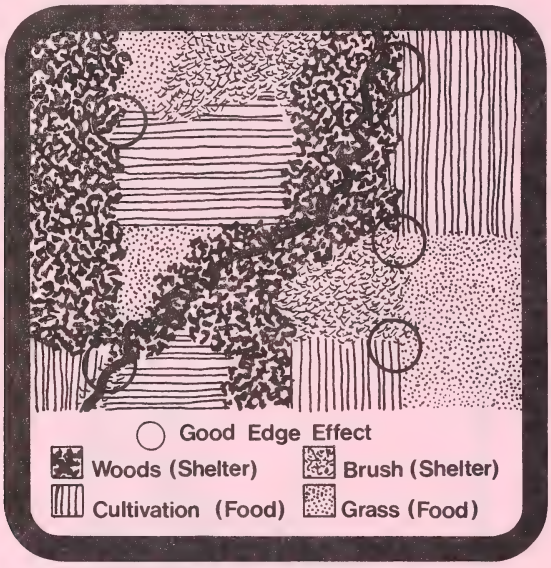
Wildlife and Plant Succession

Each species of wildlife has unique habitat requirements. Therefore, changes in habitat will effect changes in the kinds of wildlife associated with it.

In the example of coniferous forest succession, elk might be found grazing on the open grass areas made possible by the removal of the trees. As willow and low shrubs take over, moose take advantage of the abundance of their preferred food. The climax coniferous stage accomodates such species as fisher, marten and red squirrels. An older spruce forest with lichen covered trees provides ideal caribou habitat.

Edge Effect

The edges or borders of habitats overlap each other and it is here that change in vegetation is most noticeable.

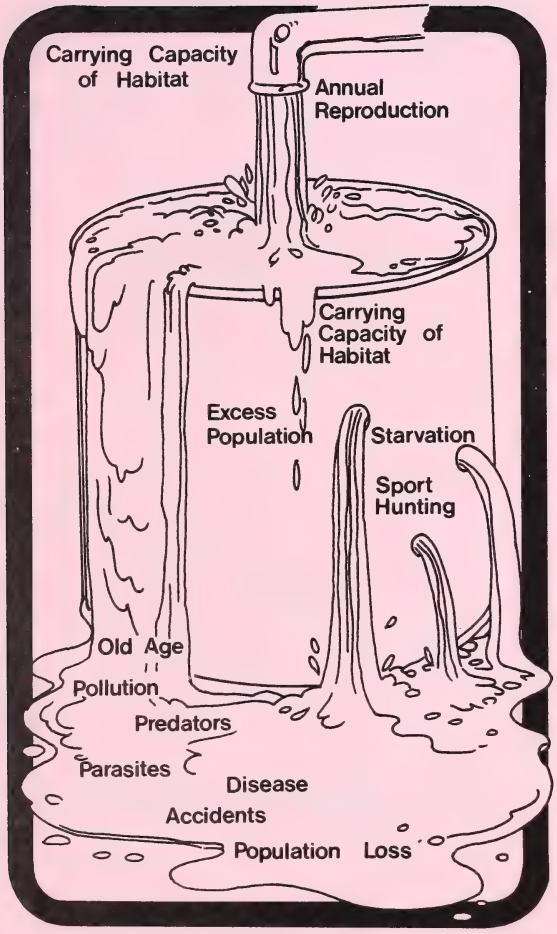


The zone of change or transition offers the greatest mixture of habitat which in turn is utilized by a high diversity of wildlife species. Ideally the best wildlife habitat has an abundance of edge arranged to provide for feeding, escape, shelter, resting and drinking all within close proximity.

Carrying Capacity

Carrying capacity is the ability of a given habitat to support or carry a number of a particular wildlife species. The carrying capacity of habitat changes from place to place, from season to season and from year to year. When carrying capacity is at its lowest, usually in the critical winter period, those animals in excess of that number must either move to new habitat or perish.

The number of ungulates living on a lush summer meadow will be sharply reduced when winter snows flatten cover and lessen the availability of food and shelter. Successional changes over longer periods of time will cause habitat change and alter that habitat's carrying capacity. Because of these changes, both short and long term, carrying capacity cannot support a fixed number of animals of a given species continuously. Over time, nature will maintain a wildlife population balance at or near carrying capacity.



Limiting Factors

Carrying capacity of a habitat is determined by any one of a number of factors. Changes in any of these individual factors may result in either an increase or a reduction of the carrying capacity.

Food:

Each wildlife species eats specific plants or animals, regardless of others that may be available. Some foods have more nutritional value than others which may vary according to the time of year. For this reason, both the quantity and the quality of food may limit the abundance of the wildlife dependent upon it.

Cover:

Wildlife needs cover to shelter and protect it while feeding, sleeping, breeding, roosting, nesting and travelling, or to escape from

predators. Cover can take many forms, such as vegetation, burrows, rocks or other features. If a particular kind of cover is in short supply, it may also limit wildlife populations.

Water:

All wildlife needs water. Sources of water are lakes, ponds, streams, dew, snow, and succulent (juicy) vegetation. Some animals can also use metabolic water (water produced by chemical processes in the body). Water may be required only in small amounts for drinking, or in the case of fish and mammals like beaver and otter, in much greater quantities as the principle component of their habitat.

Space:

Wildlife needs space if it is to survive. Overcrowding leads to severe competition for the habitat components essential to life. For this reason, only a specific number of animals can live in an area (carrying capacity).

In addition, wildlife may have territorial requirements associated with mating and/or nesting. Many species of wildlife occupy a home range and spend their entire lives within that range. In the case of white tailed deer, they rarely move beyond the 150 to 200 acres that comprise their home range.

Predation:

Any animal that eats another animal is a predator and the animals they eat are their prey. Predators are generally opportunists. Animals that are either very young or very old, or those weakened by disease, parasites or malnutrition are most likely to first fall prey to predators. When a prey population is low, the predator must find other species to prey on or its numbers will also be affected. Since most predators are well adapted to pursue and take only a few prey species, their numbers are very much dependent on the abundance of their specific prey. This has been dramatically demonstrated by the relationship between lynx and varying hares over a number of years.

Weather:

This is undoubtedly a major factor in determining population numbers. In Alberta virtually all other limiting factors are directly or indirectly influenced by climatic conditions. Climatic changes (weather) will obviously affect the cover, food, water, space and other components of habitat needed by wildlife.

Human Activities

Human activities such as alteration of habitat, killing of wildlife, impairment of reproduction by pesticides and harassment of wildlife can also serve to limit both numbers and kinds of wildlife in a given area.

Disease and Parasites

The effect of disease and parasites on a wildlife population may range from lethal to debilitating. At the extreme, die-offs of wildlife may occur, thus severely reducing population numbers. At lesser levels of infestation, reproductive capacity may be impaired and the ability of a population to sustain itself can be seriously affected.

Population Dynamics

A population is a group of animals of the same species that occupy a particular area. Dynamics refers to motion or change from within. Population dynamics, therefore, means the changes that occur in a population over time. The study of population dynamics helps explain why wildlife populations must be managed and how.

Two major factors affect the population dynamics of wildlife - the birth rate and the death rate.

Birth Rate:

Most wildlife species have a high birth rate. The smaller species of wildlife have higher birth rates than the larger species. The most important factors that affect the birth rate are:

- age at which breeding begins
- number of births per year for each breeding female (how many times each year young are born)
- number of young born per litter. How many at a time?

Death Rate:

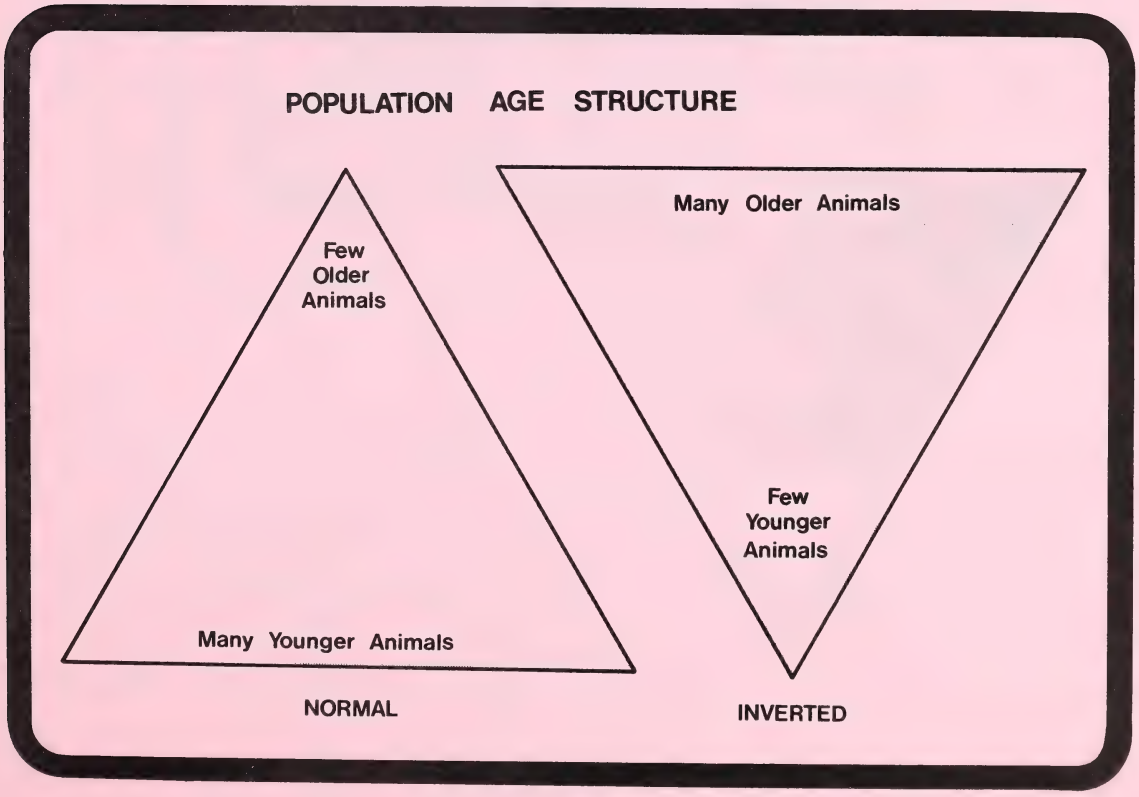
The death rate of most wildlife species is high. The smaller species of wildlife have higher death rates than the larger species. The principal factors affecting the death rate of wildlife in Alberta are:

- availability of food and cover
- predation
- weather
- human activities
- disease and parasites

Note that these are generally the same factors discussed earlier in relation to limiting the carrying capacity of a habitat.

Principles of Inversity and Compensation:

Two principles of ecology deserve mention at this point. The first is often referred to as the "Law of Inversity". Simply stated, it means that as the survival of breeding populations increases, the survival of their offspring will decrease. The result would be a wildlife population composed mostly of older animals and very few young.



When the breeding population declines, usually the number of young per litter increases. The reverse is also true, as for example with white-tailed deer populations on the prairies. Following a mild winter many adults of breeding age will survive. Under these conditions, the number of fawns produced is low, generally only one per doe. When severe winters have reduced the adult population, twin fawns are commonly seen.

The second principle, applicable to the death rate, is often called the "law of compensation". If one or more factors affecting the death rate decline, others will increase so that overall death rate will not significantly change. Over a given time period, the same number of animals in a population will die due to one cause or another. Thus you cannot stockpile wildlife from one year to the next.

If the birth rate is greater than the death rate, population numbers will increase. If the death rate is greater than the birth rate, population numbers will decrease. If birth and death rates are equal, population numbers will not change. However, populations of wildlife species are not static - they do not remain stable and unchanging.

Seasonal Changes:

In addition to the shifts and changes that occur from year to year, populations demonstrate an even greater seasonal fluctuation in numbers.

The most obvious change in population level occurs in the spring when the young of most wildlife species are born. The extent of this immediate increase in population level will depend on the number of breeding females as well as the number of young each female produces. Cow moose and elk may bear one or possibly two calves, while a hen mallard may hatch 12 to 14 new additions to the populations of that species. Not all young will survive, but understandably, populations reach their peak levels in the spring. At this time of the year, habitat is at its best, offering lush new vegetation for the herbivores or plant-eating forms of wildlife and large prey populations for the predators.

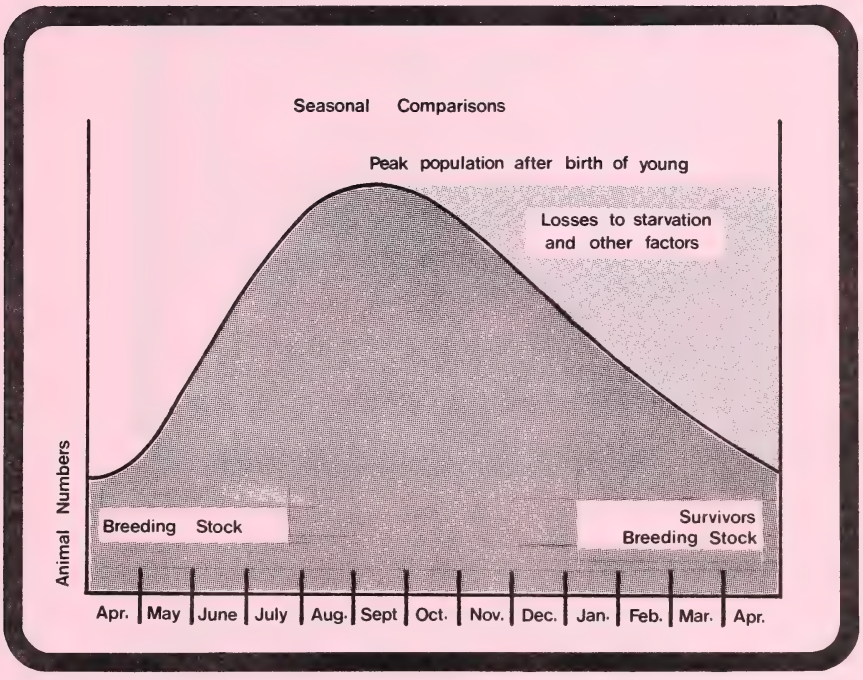
Though many animals will die over the spring, summer and fall, the winter period is the heaviest period of mortality.

In winter, the ability of habitat to support a large number of animals is reduced, often drastically. Those animals in excess of the number that the habitat can then support become surplus and may be lost to starvation and other factors. This annual mortality is part of the natural cycle. All that is required in nature is that a sufficient number of animals - the breeding stock - will survive until the spring and the cycle starts over.

Surplus wildlife cannot be stockpiled and saved for future use. A surplus is used or lost.

The average life span of most wildlife species is less than three years. All forms of wildlife are living creatures that will inevitably die and be removed from the population. This loss is replaced by the birth and addition of new individuals to the population.

Man's ability to control and manipulate both the rate of depletion and the factors that influence the rate of production of a wildlife population forms the basis for wildlife management.



GAME MANAGEMENT AND CONSERVATION

Using the basic principles of ecology, wildlife managers attempt to maintain and manage wildlife populations. Wildlife is one of our valuable resources and in this context wildlife managers are really resource managers. A resource can be defined as "any available supply that can be drawn upon when needed".

Natural resources are those resources supplied to us by nature, for example, plants, water, soil, minerals and wildlife.

Some resources, once drawn upon and used, are then no longer available to us. Coal, gas and oil are examples of natural resources that cannot be replenished or replaced once they have been used. They are called "non-renewable resources". Other kinds of natural resources can replenish themselves through natural means and thus continue to remain available for further use. These resources such as vegetation and wildlife are termed "renewable resources".

Game Management

Game Management can be thought of as a field of "applied ecology" and is in many respects, very similar to the practice of agriculture or forestry. A forester plants trees, allows them to grow and eventually harvests them. A rancher must continually remove and market animals from his herd to keep it within the carrying capacity of the range he has available for grazing. If he did not do this, the yearly addition of calves to the herd would increase the number of animals to a point beyond the capacity of the land to support them.

Similarly, game managers try to control wildlife populations. A sufficiently high breeding population is maintained to maximize the reproductive potential of that population. As with the rancher, there is a need to remove or harvest a portion of that population to keep it within the ability of the habitat available to support it. In essence, game managers "farm" wildlife just as the rancher manages his herds. Through hunting, the wildlife manager crops portions of game populations just as the rancher removes and markets the surplus portion of his herd.

The science of game management is more than simply exercising control of population numbers by controlling harvest. Today, the game manager manages not only the species but the ecosystem in which it occurs. Through manipulation of the various factors which affect game species and limit carrying capacity of their habitats, he attempts to maximize the crop of game available for harvesting. This can generally be done by developing habitat to create more space, food, cover or other critical component. Although primarily done to benefit a game species, the creation of new habitat will also benefit many other kinds of non-game wildlife.

Why Manage Game?

Few Albertans who enjoy the outdoors really understand or fully appreciate the basic objectives and principles of game management in Alberta. The primary objective of game management is to maintain game species, in sufficient numbers and variety, throughout Alberta to meet the present and future economic, recreational and aesthetic needs of the people of Alberta. Game is a publicly owned resource.

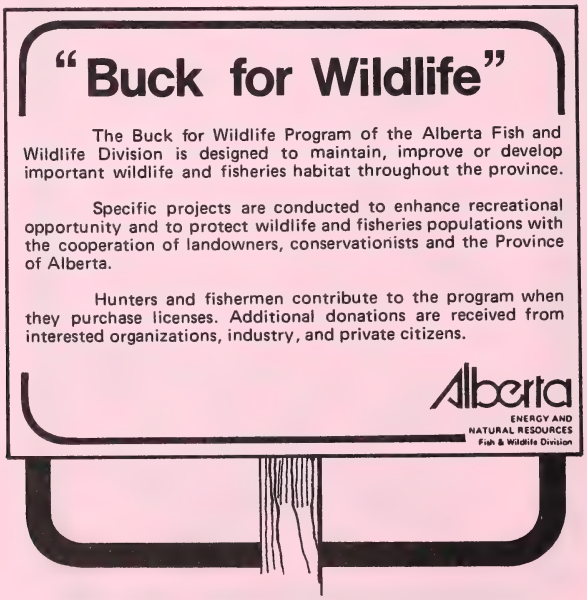
Through their game management programs, two government agencies share the responsibility for meeting this objective. The Canadian Wildlife Service, a federal government agency, has responsibility for all migratory birds in the province as well as the management of all wildlife occurring within the National Parks in Alberta. Management responsibilities for migratory birds are shared with the United States and Mexico under the terms of the Migratory Birds Convention Act.

The Fish and Wildlife Division of the Department of Energy and Natural Resources, a provincial government agency has responsibility for all other wildlife within the province.

Together the two government agencies, in concert with many private organizations, landowners and concerned citizens work actively to ensure the future welfare of Alberta's wildlife.

Who Manages Wildlife?

As shareholders of Alberta's wildlife, all citizens should be concerned about its welfare. Private landowners are in a position to benefit wildlife through the maintenance of wildlife habitat under their control. Funding from citizens and other financial help from programs such as "Buck for Wildlife" can also help maintain wildlife. Everybody can communicate their wildlife concerns to their M.L.A.'s and the Fish and Wildlife Division. The Government of Alberta, through Cabinet decisions, represents the final authority on wildlife management in the province. They determine the amount of funding to be provided for this purpose annually.



Sportsmen and other users of the resource can also contribute to its welfare by conscientiously following the rules and regulations associated with wildlife management. Through a public communications program, the Division works to ensure a better public understanding of wildlife laws.

Fish and Wildlife Divisional staff as well as Hunter Education Instructors work with schools and a wide variety of groups and organizations to increase public awareness of wildlife management and the need for resource management. Organizations from the private sector such as the Alberta Fish and Game Association, Ducks Unlimited, the Federation of Alberta Naturalists and others also cooperate in this effort.

To ensure an opportunity for public organizations concerned about wildlife management input and direction for wildlife management, a Fish and Wildlife Advisory Council, drawn primarily from public organizations having an interest in wildlife meets regularly with government staff and makes recommendations to the Associate Minister of Public Lands and Wildlife.

WILDLIFE MANAGEMENT SYSTEM COMPONENTS AND TECHNIQUES

Biological Research

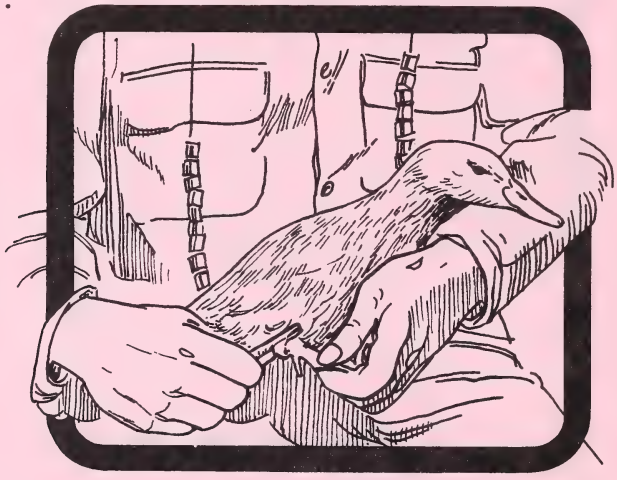
Across North America, wildlife management systems and techniques used do not vary significantly. Techniques are standardized and differ only in relation to the wildlife species to which they are being applied. In each case the wildlife manager must be able to accurately determine a number of

basic items of information about the resource he is to manage. Biological research provides the foundation for management programs through developing wildlife management techniques and providing basic information on wildlife ecology.

Two of the many biological research needs for managing wildlife are:

1. Techniques for accurately estimating numbers of particular wildlife species in a given area. Since wildlife populations are not static but continually changing, methods for determining and evaluating these changes must also be designed.

   Methodology for identifying age and sex classes of populations is also required for predicting birth and death rates. In addition to estimating population size, information is also needed concerning the movement of a species. Animals are captured, marked with distinctive tags or bands and released. Subsequent sightings and information from animals harvested by hunters provides data for determining the range of a population and whether such movement is sporadic and random or of a regular migratory nature. Some individuals are fitted with radio transmitter collars enabling biologists to continually monitor their movements.



2. Determining the lifestyles and biological needs of various species. This very basic information is needed to be able to determine the habitat requirements and carrying capacities of that habitat for each species.

Inventory

As discussed earlier, it is of prime importance for the game manager to have a reliable count or estimate of the numbers of individuals in populations of wildlife species. This information, when related to an inventory of the areas's habitat, will make it possible to estimate the area's carrying capacity and calculate the potential "surplus" population.

The difficulties encountered in trying to accurately count wild animals are many. Populations may be thinly spread over large areas or may be tightly packed into herds or flocks of hundreds or even thousands of individuals. Most wild animals avoid man and can be difficult to see and count under ideal conditions.

Difficulties notwithstanding, the most accurate method of determining the number of animals in a given area is to physically count them. Since big game populations are usually surveyed from the air, total counts of every individual of any particular species would be very costly. Attempts to count all, or as many as possible, of the animals present are restricted to only a few species, such as whooping cranes, mountain goats or big horn sheep. Nearly all other game species are censused by first identifying and inventorying the specific habitat appropriate to each species. Small representative portions of this habitat are surveyed and game counts taken. From these sample areas, estimates can then be made as to the number of animals that would be found in other areas of similar habitat and a total population figure for the province arrived at. For example, by counting deer seen from the air on a 1/16 mile strip on either side of an airplane, the average number of animals can be determined and estimated for larger areas of habitat. This is usually a conservative estimate as not all

animals in the survey area will be seen, because of variable cover and terrain. Big game surveys are usually flown during winter months when trees are leafless and the snow on the ground helps to make animals more visible from the air. If possible, surveys are flown at a time when sexual differences are most obvious, as for example, before moose, deer or elk have shed their antlers. Survey personnel are trained and skilled in their ability not only to spot and identify animals but to accurately classify them into their appropriate sex and when possible, age groups.

Other species of game, not as easily observed directly, require different techniques for censusing. Sound counts are used for pheasants and ruffed grouse. Ruffed grouse make a drumming noise on an average of every four minutes in the early morning and late evening during courtship. If a series of four minute stops are made at regular distance intervals, the average number of drums per stop can be counted and then used as an index for spring breeding populations each year. Spring pheasant populations can be monitored similarly by listening for and counting the number of cock pheasants crowing in a given period.

In other circumstances, animal tracks, degree of use of vegetation, or counting scats (animal droppings) can be used to estimate population sizes.

By itself, a single estimate of population, no matter how accurate, is of limited value. However, when surveys are done over a period of years they provide a basis for determining whether populations are on the increase or in a decline.

Nearly all other game species are censused by first identifying and inventorying the specific habitat appropriate to each species. Small representative portions of this habitat are surveyed and game counts taken. From these sample areas, estimates can then be made as to the number of animals that would be found in other areas of similar habitat and a total population figure for the province arrived at.

Estimates of population sizes or numbers of animals present in an area mean little except when used in reference to the carrying capacity of habitat in that area. In order to accomplish this, wildlife habitat must be inventoried as to the wildlife it is capable of supporting. Since the capability of habitat to support wildlife may vary greatly from season to season and year to year, habitat assessment must take these changes into account.

Many species of wildlife occupy different habitats at different times of the year. In winter, elk move down from the higher open mountain slopes to take advantage of the less severe conditions and greater protection found at lower altitudes. The herds will move back up to the green slopes the following spring and remain through the summer. In cases such as this, both winter and summer habitat must be inventoried and assessed. The seasonal habitat with the lowest carrying capacity is the most critical and constitutes a limiting factor on the total population.

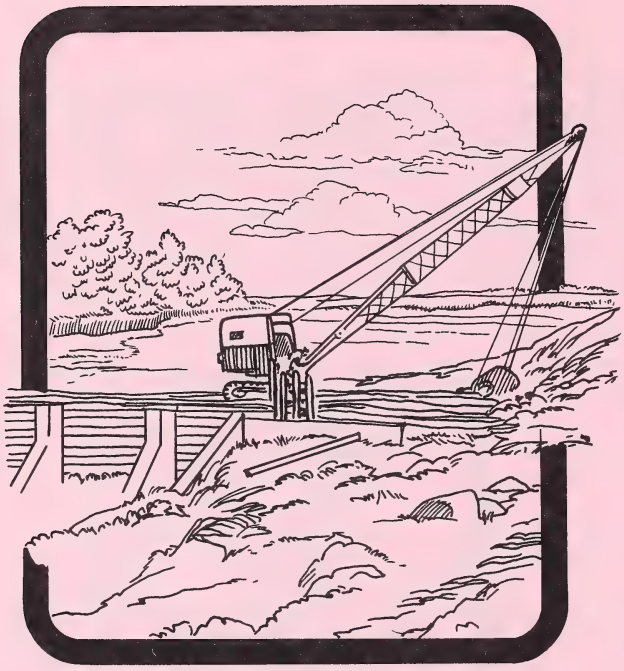
Waterfowl and other migratory birds make regular annual movements of even greater magnitude. Some species, such as the blue-winged teal, migrate to winter habitat as far away as Central and South America returning to Alberta to nest the following spring. In addition to identifying and evaluating the two separate and distant habitats required by the species, the travel routes between require identification.

The paths or flyways used by waterfowl during their annual migrations have been well studied making it possible to predict where, and to some extent when, various species of waterfowl will be found during migration. These staging or stopping places used during migration are critical habitat areas for waterfowl. Such information is needed in the setting of seasons and bag limits to ensure an equitable sharing of the resource with the United States and Mexico under the Migratory Bird Convention Act.

Habitat Manipulation

Habitat is the complex of soil, water and plants, commonly called "cover" in which wildlife exists. The relationships between soil, water, plants and the species of wildlife dependent on them are many and varied. One of the greatest influences on habitat is that of seasonal change. The cold, leafless and barren vista of winter is in obvious contrast to the warmth and lush growth of spring and summer. These seasonal changes in habitat have direct relation to the ability of habitat to carry or support game populations.

Man and his activities can cause profound and often irreversible changes in habitat, usually to the detriment of wildlife. In order to maintain productive wildlife habitat, sound planning programs concerning man's use and future of habitat components are necessary. Both short and long term planning for use of our land and water resources must include a recognition of the need to maintain suitable habitat if native wildlife is to continue to flourish. Agriculture, timber harvest, extraction of coal, oil and gas, as well as our use of water must be based on and guided by sound land and water use planning. Both the private sector and the many agencies of government, including wildlife resource managers, are cooperatively working and planning to minimize man's effect on habitat and the wildlife dependent on it.



Habitat, like wildlife, cannot be "preserved" perpetually in a particular stage or condition. In any natural system, changes are constantly occurring. Plant food used by wildlife germinates, grows, matures and is replaced by other plants. Each stage in the series or succession of changes that occur constitutes a different kind of habitat and results in an accompanying change in the wildlife found there. An area that is diverse in habitat, which offers a variety of different kinds of cover, will maintain the greatest diversity or kinds of cover, will maintain the greatest diversity or kinds of wildlife. Habitat provides more than food. It also provides protection and means of escape from predators or the elements. Strip or patch cutting of trees, rather than clear cuts with complete eradication of forest over large areas, will provide food and shelter for wildlife because of the increased amount of "edge" created. The planting or retention of shelterbelts will do the same for wildlife in agricultural areas.

Once research has identified the habitat requirements of a game species and inventory has determined the abundance of that habitat, the wildlife manager can decide whether or not to alter or manipulate habitat using various techniques. One method used involves the creating of a particular successional stage of cover for the wildlife species desired and maintaining that stage as long as possible. Fire is used as a management tool to accomplish this. Coniferous areas can be cleared and the growth of willows and dogwoods, browsed by moose, encouraged. The provision of such habitat increases the carrying capacity of the area and game populations for which it was created increase accordingly.

Blasting potholes and controlling water levels by damming has helped create new nesting habitat for waterfowl. Construction of small nesting islands in shallow lakes or sloughs has had a major effect in increasing Alberta goose populations in local areas. Planting of shrubs and shelterbelts has been used extensively to provide upland overwintering habitat for pheasants in southern Alberta.

Much of the funding needed for creating, improving and maintaining wildlife habitat is provided by hunters and other sportsmen. A portion of the annual fee paid for wildlife certificates (part of the hunting licence) is allocated to the "Buck for Wildlife" program which helps to finance wildlife habitat projects throughout the Province.

Wildlife Population Manipulation

In addition to modifying habitat, wildlife managers also use various techniques to alter the abundance and distribution of game populations. Much of this is accomplished through varying the seasons and bag limits associated with the annual sport hunting harvest.

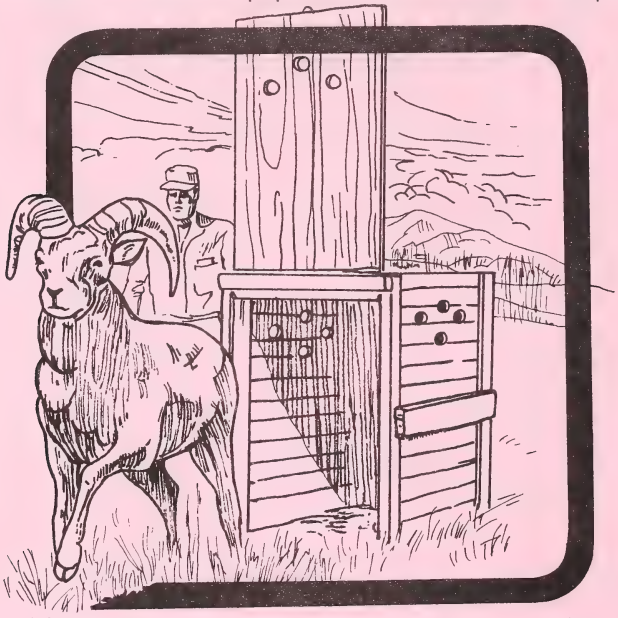
PREDATORS AND PROBLEM WILDLIFE

In the past, game managers placed a heavy emphasis on reducing predator populations in the mistaken belief that, by doing so, game animals would be more abundant. Bounties were used as an incentive to encourage people to shoot or poison predators. Game managers now have a greater appreciation for the true role and value of predators in natural systems. Resource managers now realize that it is most beneficial to maintain a diversity of wildlife including predators to maintain healthy game populations. Towards this end bounties and the poisoning of wildlife have been eliminated and severely restricted in Alberta.

Wildlife can sometimes conflict with man's interests and activities and may present a problem to the landowner. Damage to grain crops by waterfowl, use of haystacks by feeding elk or destruction of beehives by bears are examples of such conflict. Problem wildlife programs of the Division emphasize prevention of the problem and involve removal or displacement of wildlife only as a last resort. Current programs include bait or lure stations for waterfowl and protective fencing for haystacks and beehives. In some cases, the farmer or rancher may be partially compensated for his loss through a wildlife damage fund. This fund is maintained by contributions from sportsmen and various levels of government. Hunting can be an effective means of controlling or reducing wildlife damage caused by game species. In some cases it may be possible to increase bag limits or extended seasons in specified damage areas to effectively reduce populations of particular problem species.

Wildlife Rearing and Stocking

Some birds are raised in captivity for release into the wild. In Alberta this is done to bolster populations of wildlife species in particular areas.



Other wildlife species are trapped and moved to other areas to re-establish them within their former range or expand their natural distribution.

New non-native or exotic species of wildlife have been introduced in Alberta on several occasions. The successful introduction of ring-necked pheasants and Hungarian partridge are examples. Primarily, because of habitat loss, natural self-sustaining populations of pheasants have declined substantially over the past few years. To augment natural populations and provide additional sport for the upland bird hunter,

additional pheasants are raised in the Brooks Wildlife Centre and released each fall. Licenced private operators may also raise and release game birds for shooting as a commercial enterprise.

Sport Hunting

Sport hunting is used as a tool of wildlife management. Hunting controls are man-made and comparatively easy to manipulate. The effect of hunting varies with the species being hunted and the methods employed. In wildlife management, hunting is used to remove a portion of the annual surplus before it is lost to "natural" causes. The hunter thus serves as a compensatory factor (see: "Law of Compensation"). At the same time, it provides the hunter with an opportunity for outdoor recreation. Hunting also provides wildlife biologists with a chance to sample game populations and gather data relative to distribution, sex, age, and the physical condition of the animals in them.

Sport hunting is useful in helping to alleviate local problems caused by bears, wolves, elk, ducks or other potentially problem species.

An often heard public concern about hunting is that a species may be depleted to the point of becoming endangered or even extinct. The "Law of Diminishing Returns" generally works to prevent the "shooting out" of game animals. As a population decreases, the remaining animals become more wary, widely separated and harder to find. It then takes more effort on the part of the hunter to get game. Beyond a certain level of effort required, most hunters will lose interest and turn to hunting other species, or move to other areas. Even at low population levels the animals taken by hunters are a part of the harvestable surplus. These are animals that, if not taken through hunting, would be removed from the population by some other factor in the environment. Regulated hunting makes it possible to harvest animals when populations are at or close to their highest numbers over the year. By removing animals before the critical habitat conditions of winter occur, more food and cover is left to the remaining population and increases its chance for survival. Pheasant populations, for example, will be reduced by 90% or more due to winter mortality, whether they are hunted or not.

Control over the number of animals harvested can be achieved in several ways. Bag limits (the number of game animals each hunter is allowed to take or possess) can be raised or lowered. Female animals may be taken in some zones and not in others. Hunting seasons for a particular species may vary from a few days to several months depending upon the species. In any particular area or wildlife management zone, a hunting season can be opened for some species and closed for others.

Fish and Wildlife
Slide Commentary

1. Wildlife cannot survive without adequate habitat -- a place for each species to feed, drink, rest, breed and escape danger. This is a scene in the parkland wildlife zone of Alberta, illustrating a wide variety of habitat types -- from grasslands to woods to water. A diversity of habitat ensures a diversity of wildlife.

2. As man's demand for resources increases, wildlife habitat is changed or destroyed. For agricultural purposes, much wildlife habitat is cleared and replaced with monoculture crops. Many wildife species are forced to leave, but others (like the white-tailed deer) are attracted, provided that some wild habitat remains. In this picture, islands of the original wild habitat are surrounded by grainfields -- good habitat for deer, grouse, pheasants, songbirds, and other wildlife. Portions of land that are only marginally valuable for agriculture may best be left for wildlife.

3. This is an ideal trout stream. Heavy bank cover provides shaded areas and retards bank erosion. This type of cover provides food in the form of insects dropping into the stream from the vegetation. Cut banks establish resting and feeding areas for trout.

4. This is a stream lost for trout production. The adjacent land is overgrazed, allowing erosion to wash sediment from the banks into the stream course. The siltation covers spawning beds. The lack of vegetation along the shore raises water temperatures, and an important source of food is gone. This stream would only support fish that can stand the higher water temperatures and can look for food under the sediment -- such as suckers.

5. Biologists use several methods to manage the fish and wildlife resource. Here a moose has been captured in a trap, where it can be tranquilized and studied to determine its sex, age and health. This information, taken from several animals, is used to assess the condition of the moose population in a particular area of the province.

6. This moose has been ear-tagged and a radio collar has been placed around its neck. The ear tag identifies the moose, and allows biologists to follow its progress through the years, as the moose is recaptured or when it is shot by a hunter and the hunter turns the tag into a local Fish and Wildlife Office. The radio on the collar broadcasts a signal that can be picked-up by

biologists using a receiver in a truck or airplane, and the animal's location can be pin-pointed. This provides information about how far each individual moose travels to obtain its food, water and shelter. From this and other information, wildlife managers set hunting seasons and bag limits that ensure that there will always be moose to hunt and enjoy in the future.

7. Some populations have been over-exploited by man and require help to be maintained and enjoyed. Some populations of sport fish require the artificial raising and stocking of young fish to provide anglers with the fish that they require. Here a lake trout is taken from a net in a lake where these fish are spawning.

8. Eggs are stripped from the females, and spawn (sperm) is stripped from the males before the fish are released back into the lake. The eggs and spawn are mixed to fertilize the eggs. The eggs are then transported to a hatchery where they are allowed to hatch and grow to a certain size under controlled conditions. The young fish are then released into lakes where fishing demand for lake trout is high.

9. The Fish and Wildlife Officer has many jobs both in the field and in the office. Here, an officer is investigating an illegally-killed moose. Officers must be knowledgeable in forensic techniques, as modern science can help determine who committed a crime.

10. Fish and Wildlife Officers are glad to help people understand the laws and regulations that are used to conserve our fish and wildlife resource. Here, an officer administers a licensing examination to a hunting guide.

11. Problem wildlife takes up much of an officer's time. Whether it's blowing up beaver dams that are flooding agricultural land, or trapping nuisance bears, it is the local officer's responsibility to look after public well-being and safety where wildlife is concerned.

12. Many problems with wildlife can be avoided by applying some preventative techniques. Here an electric fence has been placed around a bee yard to prevent bears from entering. After an encounter with the fence, a bear learns not to return to this bee yard.

FOREST CONSERVATION

FOREST CONSERVATION IN ALBERTA

Prepared for Alberta 4-H Conservation Camp

by

Jan T. Simonson

Alberta Forest Service

1985

INTRODUCTION

A Land of Trees

Apart from its sparsely populated North and the grasslands of the prairies, most of Canada's land is blanketed by trees, roughly 40% of its total area. From this "sea of green" Canada harvests 150 million cubic metres of wood a year, enough to build a bridge 4.25 cm thick, just over 8.5 m wide, stretching from here to the moon.

Alberta's forests cover about 60% of its area, and each year grow enough wood to build a skyscraper out of solid wood 28 km high. About one third of this wood is harvested each year contributing significantly to the economy and social fabric of Alberta.

Forestry is Canada's most important industry and Alberta's third most important industry. Since the time when people gathered firewood, nuts and berries, or constructed the first wooden houses, forests have provided us with food, warmth, shelter and a wealth of forest products. In addition to these essential items, forests supply us with an abundance of clean water, an anchor for soil and recreational areas of unsurpassed beauty. They provide a home for numerous species of wildlife.
Our lives would be dramatically different without trees.

Forest

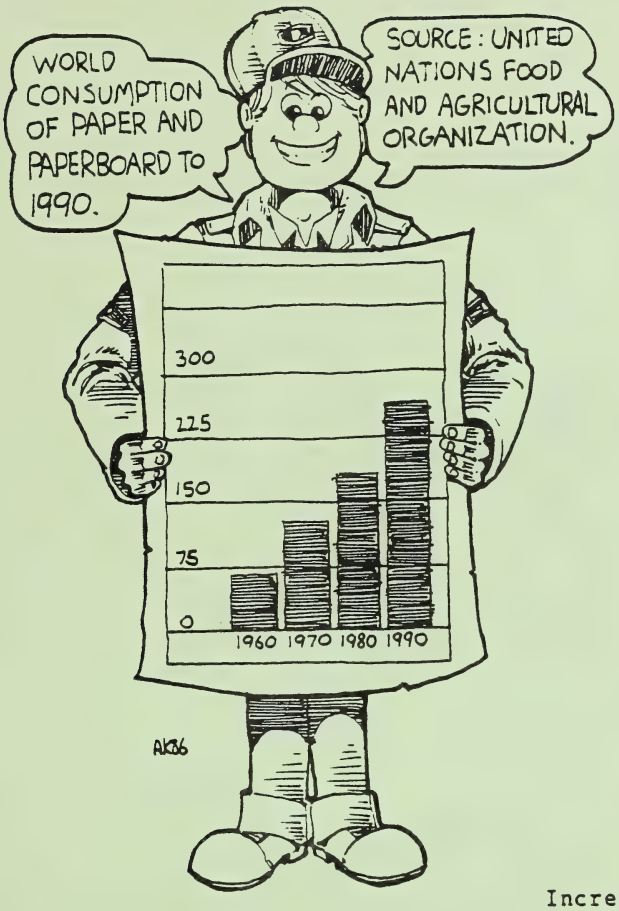
A forest is a biological community dominated by trees and other woody vegetation. The word forest is derived from the Latin foresta, meaning an unenclosed wood.

Tree

A tree is a perennial woody plant having a self-supporting trunk of considerable height, with branches and foliage at some distance above the ground. The word is derived from old English, treow.

Forest Conservation

As vast and varied as our forests are, their future cannot be taken for granted. We use our forests extensively and long periods of time are required for re-growth and reclamation after various uses. Forest conservation is essential for ensuring perpetuation of this valuable renewable resource.



Increasing demands for wood products can affect the forest industry in Alberta, maintaining the need for sound forest conservation programs.

Forest conservation is a process which improves the quality of life for generation after generation. It is a process of managing our relationship with the forest to ensure a supply of benefits on a perpetual or sustained basis while maintaining its health and integrity.

Benefits we receive through forest conservation include wood products, clean water, wildlife habitat, recreational space, rangeland and ecological reserves. By applying basic forest management principles, we can control the desired outcome of various forest management programs - timber harvesting, insect and disease control and fire hazard reduction.

Before we apply forest management principles we need to know how trees grow, how they are established from seed, how fire affects them, and so on. In other words, before we manage something, we need to know what we are managing. The study of forest biology and ecology helps us do this.

Forest conservation provides us with benefits and ensures the perpetual renewal of a healthy forest.

FOREST BIOLOGY/ECOLOGY

Biology vs. Ecology

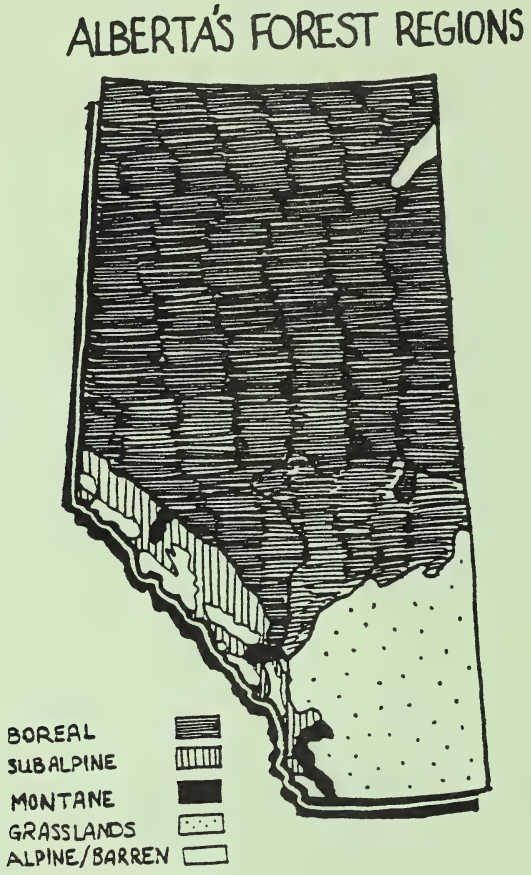
The old adage "you can't see the forest for the trees" aptly describes the study of forests. If we were to study only the trees, we would not understand the forest.

Forest biology is the science which studies the structure and function of the forest. It involves the study of how trees grow, reproduce and die. The science of ecology, which studies the interrelationships between living things and their environment, helps us to understand the forest as more than a collection of trees. It helps us predict, monitor and evaluate changes in various parts of the system whenever we change the way we manage it. It helps us become responsible forest managers.

Knowledge of forest biology and ecology is needed before forest conservation can begin.

Forest Regions of Alberta

A forest region is a geographic area containing a distinct combination of trees, soils and climate. Forest regions each have a different capacity to grow trees, and are affected differently by forces such as fire, insects and disease. For example, the boreal forest region is the most productive in Alberta. Remarkably, 90 percent of its area has burned at least once in the last 100 years. The map below shows the forest regions of Alberta:



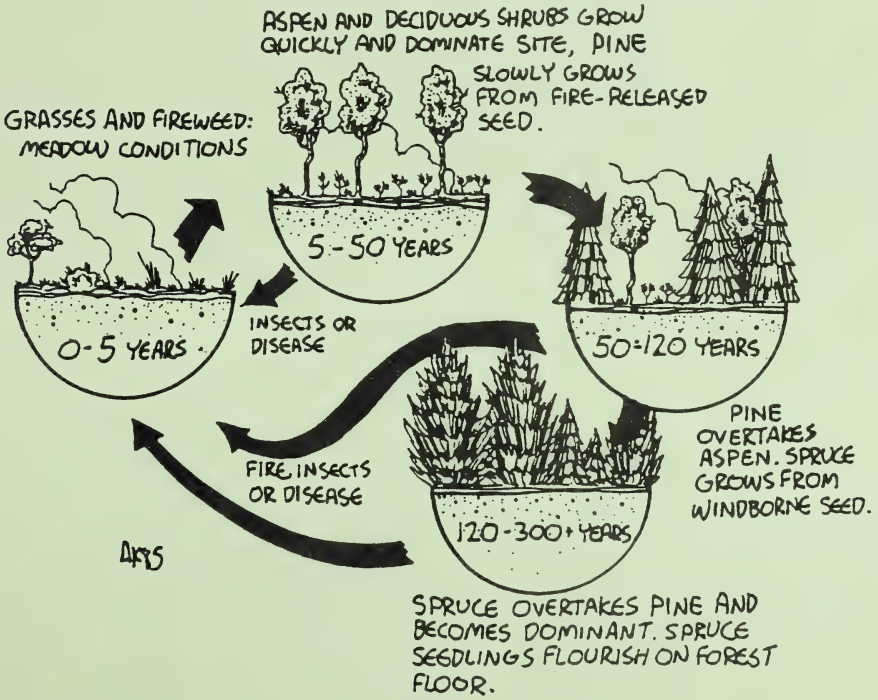
Forest Regions of Alberta

Species and Stands:

There are 15 species of trees native to Alberta. Seven are considered commercially valuable - lodgepole pine, jack pine, black spruce, white spruce, douglas fir, tamarack and trembling aspen. Trees such as balsam fir, balsam poplar and sometimes aspen are considered undesirable species. All these trees are usually found growing in assemblages called stands. A stand may consist of one or several species growing in association with each other. Stands are usually the smallest units of forest land which foresters define and work with in day-to-day forest management.

Forest Succession:

Forest succession involves the replacement of specific types of forest plants in a stand by different types over time. The process may be interrpted by fire, insects and disease, and it can set back the forest clock to an earlier successional stage. For example a spruce stand may be destroyed by fire and replaced by a stand of aspen and dense shrub growth.



Generalized forest succession in the boreal forest region of Alberta.

We can influence succession in a forest stand where we wish to promote growth of a desireable tree species. For example, we may score the soil surface after harvesting to promote the growth of pine trees, or we may plant spruce seedlings in areas with not enough young trees. Herbicide is being investigated as a means of controlling undesirable aspen growth in certain areas.

Given the life span of trees and the fact that succession varies from stand to stand, we see that a forest may be composed of several stands of different species, ages and sizes. Stands will reach harvesting age at different times and will have varying susceptibilities to fire and disease. Management options become as varied as the forest itself.

Reproduction and Distribution:

Knowledge of the ways trees reproduce can be applied to the reforestation of harvested sites and burned areas in various ways, including cone collection, seed extraction, seeding and planting.

Trees reproduce sexually and vegetatively. In sexual reproduction, seed develops after pollen from a male flower has fertilized the ovary in a female flower. Seeds develop in cones on needle-leaf trees such as spruce and in true flowers on broad-leaf trees such as poplar. The seeds of needle-leaf trees are winged which helps in distribution by wind. In some species, such as lodgepole and jack pine, the seeds may be held in the cone for several years. Heat from a forest fire may be required to release the seed, when germination may then proceed in an environment relatively free from competition from other plants.

A form of vegetative reproduction is root sprouting or suckering where new shoots arise from buds located on the roots. This is common in trembling aspen when conditions are favorable, or when cut down or burned. Clumps of trees with the same genetic origin and root system result, and are called clones. Clones are easily identified in the fall when they turn color. Some clones will be gold while others will still be green.

If left alone, forests will naturally regenerate, either by sexual or vegetative reproduction. However, the results are often undesirable for forest management purposes. Scoring the soil surface to promote pine seed germination, seeding and planting are used to promote reforestation.

Wildfire! Valuable trees crackle into flame. Soil cover burns away, exposed soil is washed into streams by subsequent rains. Such images give fire a bad name, not to mention threats it poses to human life and property. However, forest fires also renew the forest-many of the most valuable forests today owe their existence to fire. Some trees have adapted to fire disturbance and in a few cases are dependent on fire for reproduction.

The prolific way jack pine, lodgepole pine, and black spruce establish themselves after a fire shows the dependence of these "fire" species on wildfires. Their most important characteristic is the closed or serotinous cone, which remains on the tree for many years. (see accompanying illustration).

Jack pine and lodgepole pine cones.

The cone scales of jack and lodgepole pine are held together by a resinous material which melts at about 49°C. In a fire, heat opens the cones, while the thick scales prevent damage to the seeds before they are released.

Following a fire, requirements for good germination and early seedling growth are usually present - exposed mineral soil, partial shade provided by dead standing trees, increased sunlight, lack of competing vegetation and release of mineral nutrients.

Severe fires, on the other hand, may seriously limit growth for several years after. The challenge for modern day forest managers is to control the effects of fire to get benefits in some situations while preventing serious damage to the forest in others.

Insects and Disease

Insects and diseases cause as much tree damage in Canadian Forests as fire. Forest insects and diseases slow tree growth, reduce wood quality and cause trees to die.

Although insects and diseases are always present in the forest, they normally are kept under control by natural enemies and bad weather. Occasionally, however, some disturbance shifts the normal balance of nature and an outbreak (disease) or infestation (insects) occurs, injuring or killing many trees. Such disturbances may include weather, fire and our introducing new species into an ecosystem. Anything that weakens trees makes them more susceptible to pests. Insects and diseases often become problems when people change a stand, e.g. a site is replanted with a new tree variety or only one kind of tree is used where there were several species.

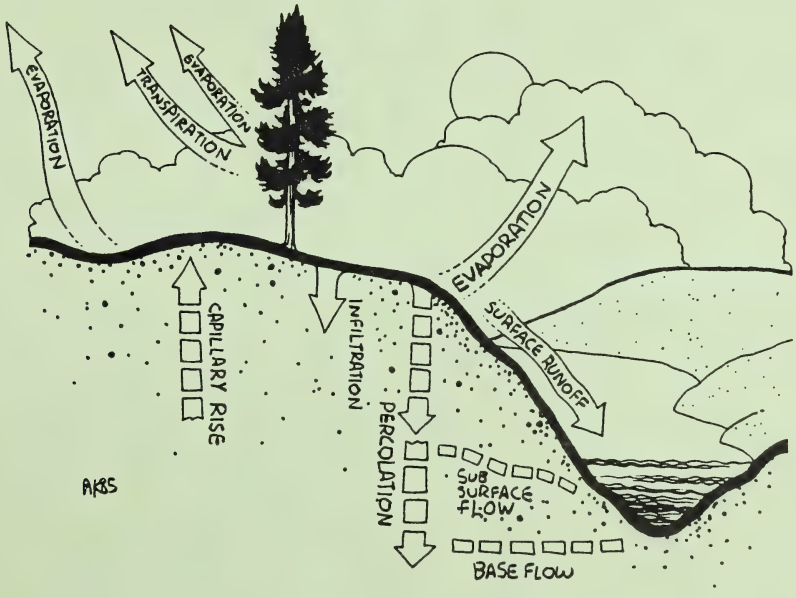
We can use various means to control insects and disease in our forest - chemical sprays, removing or destroying infected trees and biological controls. Biological controls, including the use of natural insect predators, sterile males and natural scent-traps, are proving to be promising and environmentally safe means of insect and disease control.

Forests and Water

Most people recognize that water is essential for continued survival. It supports fish populations and outdoor recreation activities. In the form of rainfall or irrigation water, it helps every type of plant to grow. Many people take the good quality and plentiful quantity of water in Alberta for granted without considering why it exists and what must be done to keep it that way.

Forests catch and collect precipitation. Vegetation intercepts some rain and snowfall, returning some to the atmosphere and allowing the rest to reach the forest floor. Dead and decaying leaves on the forest floor cushion the impact of rainfall and protect the soils from erosion. The forest cover shelters snow from wind and sun, delaying its melt in the spring.

The roots of trees and other plants hold the soil in place and improve its ability to absorb water. Water, percolating down and wetting the soil, can then be used by plants and returned to the atmosphere through transpiration when it is passed further down it recharges the water table or is passed laterally to streams as subsurface flow. Because removing trees can modify the forest's role in the water cycle, we need to be aware of potential changes and ways of minimizing harmful effects.



Forests play an important role in the water cycle.

Forest Wildlife

Within our forest landscape there is a wide variety of animal life and the rivers and lakes fed from forested watershed support an abundance of fish. The forests, too, are rich in birds, both resident and migratory. This varied population of living creatures plays an important role in the lives of Canadians and in the experience of visitors to the Canadian scene. Animals, fish, and birds populate three major living areas - the forest, the grasslands and the tundra. By far the largest of these is the forest. The importance of wildlife can, in some cases, be established in economic terms, but there are also many intangible benefits to be considered.

The effects of timber harvesting and other uses on forest wildlife must be taken into account if the effects are to benefit wildlife. Avoiding important wildlife areas, delaying operations to less critical times, leaving hiding and escape cover and preserving vegetation alongside streams are some ways for conserving wildlife during forestry operations.

Forest conservation programs must consider the needs of wildlife.

Forest Soils

Forest soil is an integral part of the forest community, and the forest plants in turn play an integral role in soil development and retention. Soils vary in texture and fertility according to geographic locations, climate and history of the forest itself. Knowledge of soil types is essential for successful management of forest lands.

Preventing soil erosion is an essential forest conservation goal.

Conclusion

Trees and forests are constantly changing - fires and insects and disease kill trees each year, often resulting in regrowth of new forests - forests catch, store and release water, making it available for other uses - forests provide food and shelter for wildlife - forest plants themselves replace others in continuous patterns of succession.

A knowledge of forest ecology is essential for the selection of forest conservation programs which fulfill the needs of people as well as ensuring protection for the forest and its resources - water, soil and wildlife.

Notes: _____

_____

_____

FOREST MANAGEMENT

Regulation and Control

Regulation and control of forest management usually depend on who owns the land. In Alberta, most of the forest lands belong to the Crown. Forest policy is controlled by the Forests Act, which provides legislated authority to the government to oversee and regulate the forest industry and related uses of Alberta's forests on crown lands. Other policies, such as the Eastern Slopes Policy, provide guidelines for forest land management in specific areas of the province.

We are concerned with four important forest management principles which these acts and policies consider - sustained yield forest management, timber management, forest protection and land use management.

Forest conservation involves the skilful application of acts and regulations on a daily basis.

Sustained Yield Forest Management

Sustained yield forest management is a policy to ensure that Alberta's forests can provide a continuous supply of marketable trees without becoming depleted in the process. This is done by controlling the balance between the volume cut and new growth.

Restricting the volume cut each year to an amount equal to new growth can be compared to spending the interest from an investment without cutting into the principal. Restricting the volume cut is controlled through timber dispositions of various kinds which are issued to forest companies. They set out areas of responsibility in harvesting, reforestation and forest management. The agreement or licence also specifies the annual allowable cut for each company, a provision that not more than the average annual growth may be harvested.

Reforestation is an integral part of sustained yield forest management. Reforestation to be effective, must follow certain rules. In Alberta, for example, cutovers must have 800 evenly spaced trees per hectare no later than 10 years after harvest - with no understocked areas larger than four hectares. As a farmer must seed a crop at a prescribed rate to ensure a good harvest of wheat or barley, so must a forester reforest areas with trees at proper spacing and schedules to ensure a sustained yield of forest products.

Once the crop of trees is established, tending the crop may be required to ensure a successful harvest in years to come. Various conditions may exist. Competition from shrubs, grasses, and other unwanted vegetation can choke off the young trees. Ongoing experimentation will result in preventing this from happening. At present, scarification is the most effective tool in controlling unwanted vegetation. Other methods, including herbicide use, are being studied.

Juvenile spacing involves thinning of the tree stands and is practised to provide more growing space and nutrients to the remaining trees. Other benefits include faster growth, improved wood quality and a better environment for humans and wildlife.

Timber Harvesting

When someone mentions forests, perhaps many of us conjure up images of logging trucks, chain-saws and lumberjacks. Certainly, timber harvesting is a major industry in our forests of today. During harvesting the important field of timber management comes into play. While the policies of sustained yield forest management aim to ensure a perpetual supply of forest products, other policies aim to ensure oderly, efficient harvesting of the forest and minimizing its harmful effects. The main environmental concerns during timber harvesting are watershed, wildlife and scenic preservation. Some of the steps involved to ensure proper harvesting are:

1. The forest is sampled and inventoried - tree species and physical data are recorded - an annual allowable cut is determined.

2. A management plan is developed, identifying a sequence of forest stands to be harvested over a 20-year period, based on the sustained yield principle.

3. Other forest users are consulted and areas are set aside for preservation and recreation.

4. Cutting rights are granted through a Timber Disposition, a legal document subject to government legislation.

5. A forest company submits an annual operating plan detailing precise area to be logged, road locations, campsites. The plan is reviewed by government foresters, biologist and watershed experts.

6. Inspections are made during harvesting.

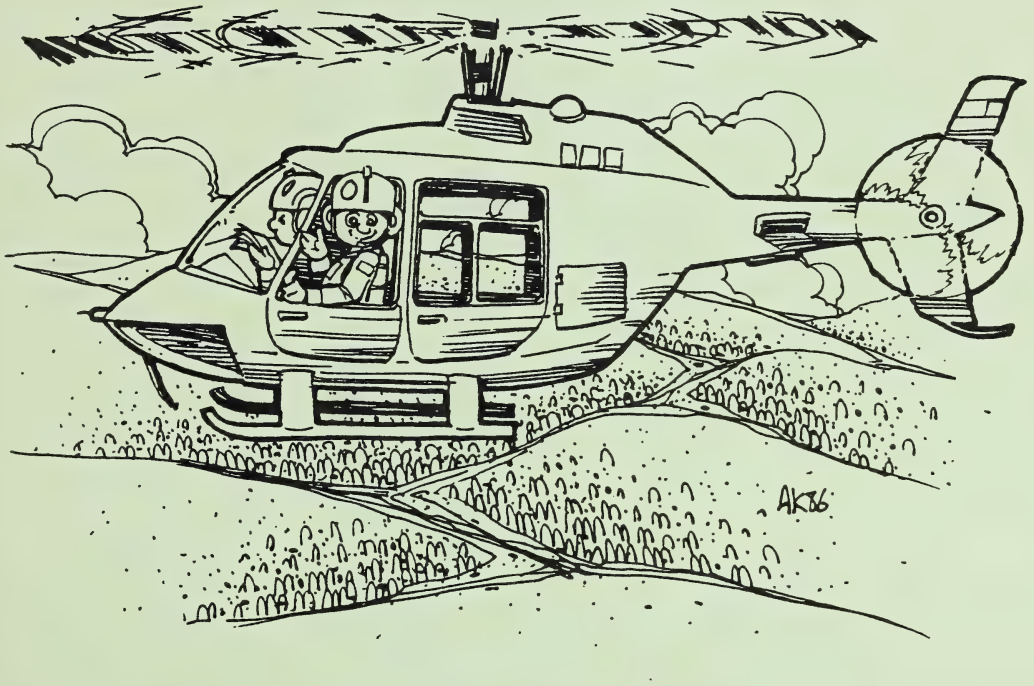
7. Clean-up, reforestation and reclamation of roads is done.

In Alberta, an approved forest management plan is required before Timber harvesting may begin.

Forest Protection

Forest protection involves programs to prevent, detect and suppress forest fires, disease and insect attacks. Because of its relatively cold, dry climate, Alberta is fortunate in having had few serious insect or disease outbreaks in recorded history. Bark beetles and dwarf mistletoe are usually present but do not pose widespread serious threats. In Alberta, the Alberta Forest Service works with the Canadian Forest Service to conduct research and implement control programs where threats or damage do occur.

Forest fire management covers a wide range of activities such as planning and operations, through to assessment of long-term consequences of a particular fire management policy. Meterological information, communication services and aircraft co-ordinating are vital aspects of fire management programs.



Aircraft are widely used in the detection, monitoring and control of forest fires, insects and disease.

Forest Land Use Management

Forest Land Use Management refers to managing various uses of forest land including recreation, grazing and petroleum development. The main concepts and techniques for management of forest land use in Alberta include:

1. Designation of Crown Lands, e.g. Green Area, Rocky Mountain Forest Reserve, Forest Land Use Zone, and enforcement of legislation governing the uses allowed in such lands.

2. Integrated Resource Management

3. Development and Reclamation Guidelines

The Green Area in Alberta was designated in 1948 and defines the extent of those forested lands on which farming and residential development are limited.

The Rocky Mountain Forest Reserve was established by the Forest Reserve Act, 1964 for the conservation of forests and other vegetation, and the maintenance of conditions favorable to an optimum water supply. Rocky Clearwater and Bow/Crow Forests are included in the reserve.

Forest Land Use Zones are areas specially designated for controlling and managing recreational uses such as off-highway vehicles and snowmobiles.

Integrated resource management is a philosophy of managing all the resources by securing the most favorable mix of uses to achieve maximum results. The goals of the program are to realize maximum overall economic and social benefits from timber, water, fisheries and wildlife resources while safeguarding the natural environment and maintaining the productivity of public lands. The program is co-ordinated by the government and public involvement is encouraged.

Various acts and policies control the use and reclamation of forest lands in Alberta in relation to grazing, petroleum and mining.

Conservation concerns in the environmental area include watershed protection, wildlife, recreation and scenic values.

Conclusion

Forest management in Alberta involves the application of four forest management principles - sustained yield forest management, timber management, forest protection, and forest land use management according to legislated acts and regulations. The overall aim of forest management is to maximize economic and social benefits from the forest while ensuring its integrity and perpetual renewal. Government, industry and the public are involved in the process.

Notes: _____

_____

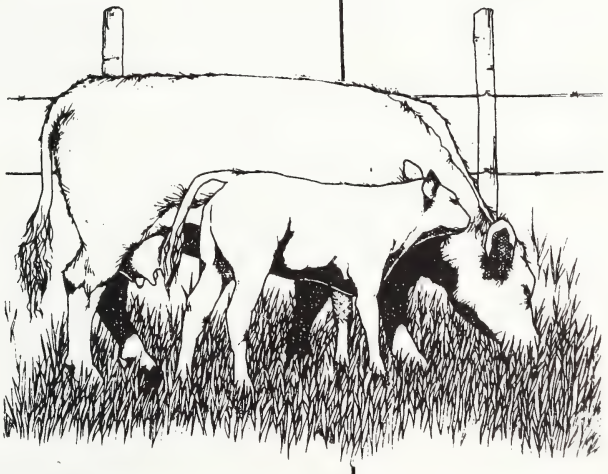
_____

SUMMARY

Forest management processes evolve and develop to fill regional needs for forest conservation. While different processes may be used in other parts of the world, the basic goals and concepts of forest management are similar - to gain benefits from the forest while assuring its perpetual renewal.

Forest conservation is more than forest management. It involves the skilful use of all forest management techniques as well as constant research into new knowledge and finding better ways of doing things. It also involves education, telling others and instructing them in the role and processes of forest management. It is an ever changing process.

RANGE CONSERVATION



R A N G E C O N S E R V A T I O N

I N A L B E R T A

Prepared for:

4-H Conservation Camp

5 in 1 Manual

by

Bjorn P. Berg
Alberta Agriculture

1985

RANGE CONSERVATION

INTRODUCTION

Rangelands. The range of the buffalo. The prairies; the foothills; cattle country. These are some of the images we think of when we talk about rangelands.

Although rangelands have many uses, the use most commonly associated with range is the grazing of large mammals. We may talk about the range of a specific animal (sheep range, elk range). Or we may describe rangelands by their dominant vegetation (grassland range, bush range), by their climate and geology (alpine range, prairie range, desert rangelands), or by their season of use (spring range, winter range). We usually think of range as producing forage for grazing animals.

Today, range is one of our most valuable renewable resources. Almost all our water comes from rangelands. Rangelands are the original source of the soils on which we now grow cereal crops. Much of our outdoor recreation is conducted on rangelands, or remnants of them. Many important wildlife species are found only on rangelands. And most of the our beef cattle industry is dependent on range.

Rangelands are not costly to maintain. However, we may pay high prices for range improvements and range development if the range is abused. Consequently we are interested in range management; with good management practices we can maintain and conserve our rangelands indefinitely.

Range Conservation

We need to conserve rangelands for the same reasons we need to conserve all our renewable resources: depleted range is no asset and no legacy. Governments have recognized this by enacting legislation designed to protect or conserve our rangelands. In British Columbia, one act, the Range Act, was passed in 1978. In Alberta, there exist various acts including the Public Lands Act and the Forest and Prairie Protection Act. However, any strategy for conserving rangelands requires planning as well as laws. Where laws may dictate the general rules of conservation, a range management plan directs the conservation of a specific range.

How do we develop a range management plan? First we set a goal. (One of the most common goals of a range manager is to obtain a sustained yield of animal production.) Next we measure the size and productivity of our range so that we know how big it is and what its limitations are. Finally, we make decisions based on our information that will help us achieve our goal. How do we conserve rangelands? Simply by setting goals and making decisions that sustain the yield of forage, water, livestock, wildlife or whatever elements have been selected as important on that range.

RANGE ECOLOGY

At some point in the development of a range management plan, we need to collect information about the range. This information will answer such questions as how many animals we can produce, what areas of range need protection or improvement, and so on. It will be used to help make good decisions about range use and conservation.

The information we collect belongs to a branch of science called ecology. There are many important ecological principles which we should know that will help us in our investigation and later in our plans.

Plant Communities

Plants collect in communities wherever the environment meets their particular needs. Thus, we look for forest communities where it's moister and grassland communities where it's drier. Plant communities are identified, described and grouped by the plant species in them.

The most identifiable characteristic of a plant community is its height. A clone of of aspen trees is taller than a clone of buckbrush which is taller than a field of speargrass. The community can be divided into a tree layer, a shrub layer, and a herbaceous layer. Any layer may be missing from a particular community. The plant which is most abundant in the highest layer usually provides the name of the community (e.g. poplar forest, fescue grassland).

The smallest unit of a plant commmunity is a stand: an area where each layer of vegetation present has a uniform appearance. A stand is composed of a definite mix of plant species in a definite mix of layers. Like fingerprints, no two stands are exactly alike, although they may have similarities.

The microcosm represented by a stand is always changing. Each plant will germinate, mature, and die. Generally, plants respond to the environment in a way that we have come to know as 'survival of the fittest'.

Sometimes in the process of survival one plant species will replace another in the stand. Over time the stand will change its appearance and composition as it adapts to a changing environment. This change from one species to another is normal and even predictable. For example, as time goes by lichens are replaced by grass, grass is replaced by shrubs, and shrubs are replaced by trees (Figure 1). This is called succession. Succession occurs whenever the stand is not in equilibrium with its environment.

Figure 1. An Example of Succession

Eventually, a stage maybe reached where the composition of the stand does not change: the stand is in equilibrium with its environment. This stage is known as the climax. All other stages prior to the climax are called seres or seral communities because they represent a single stage in a series leading to climax.

We often group similar stands together. The result is called a habitat type. A habitat is a significant plant community which exists in a specific area or region. For example we may recognize the rough fescue--Idaho fescue habitat type in the grasslands of southwestern Alberta. Habitat types can describe either climax or seral stands of vegetation.

We may also group similar habitat types together. The result is called a plant association. Usually we only identify the climax plant community common to all habitat types in the association. Thus the rough fescue--Idaho fescue habitat type in southwestern Alberta belongs to the rough fescue association.

Groups of plant associations are called ecosystems or, when the land they are on is known, ecoregions. There are 12 ecoregions in Alberta. (Table 1.)

Range Plants

Almost all plants germinate from seed, establish roots, grow leaves, stems, flowers, reproduce and die. If every species of plant did these things the same way it would be easy to write a range management plan. However, every species is a little different. So we need to be able to identify each range plant and classify it according to its adaptations.

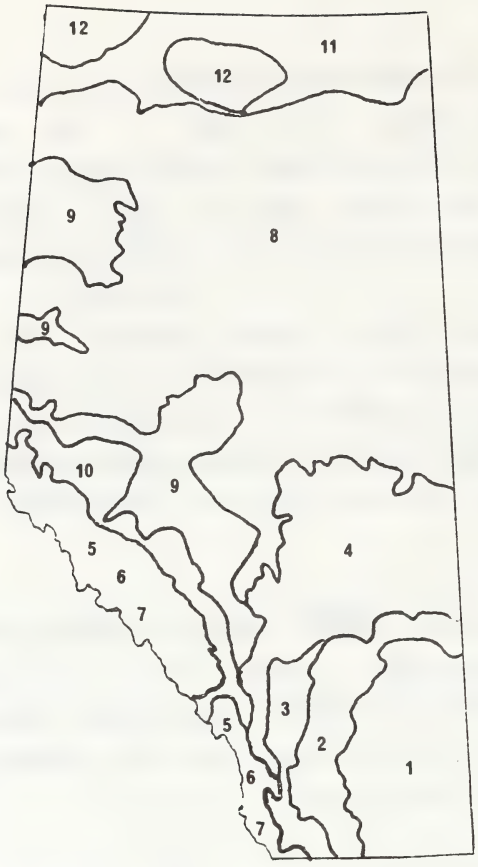


Table 1
APPROXIMATE AREAL EXTENT OF ECOREGIONS IN ALBERTA

Ecoregion Name	Ecoregion Number	Percent Area	km^2
Short Grass	1	7.1	46 926
Mixed Grass	2	4.7	31 063
Fescue Grass	3	2.2	14 403
Aspen Parkland	4	11.1	73 268
Montane	5	0.5	3 538
Subalpine	6	3.5	23 133
Alpine	7	2.8	18 506
Boreal Mixedwood	8	43.2	285 611
Boreal Foothills	9	9.6	63 362
Boreal Uplands	10	4.1	27 098
Boreal Northlands	11	7.2	47 588
Boreal Subarctic	12	4.0	26 437
TOTAL		100.0	660 933

Range plants have life spans that are annual (complete their life cycle in one year), biennial (complete their life cycle in two years), or perennial (three or more years to complete their life cycle). The most important plants on Alberta's ranges are usually biennial or perennial because they do not need to produce seed to grow again next year.

Each plant species has a yearly cycle of growth. At the beginning of each growing season the plant initiates growth by producing leaves, stems, tillers, roots and other vegetative plant parts. If this period of principle growth occurs in the spring and fall the plant is called a cool season plant. Warm season plants have their period of principle growth in the summer. Most range plants in Alberta are cool season plants.

Plants can be grouped into categories based on their form (Figure 2). Grasses are plants with jointed, hollow stems. The leaves are parallel-veined and alternate in two rows on the stems. The flower is small and inconspicuous. Sedges and rushes are grass-like plants. Their stems are not jointed or hollow. The leaves are parallel-veined as in grasses, but only rushes alternate in two rows on the stem. Sedge leaves alternate in three rows. The flowers are small and inconspicious. Forbs generally have solid stems. Their leaves are net-veined and they may be two to four ranked. Their flowers are usually large and showy. Shrubs and trees have woody stems, net-veined leaves, and showy flowers.

The origin of a plant refers to the region where it is normally found. A plant is native if it is found in the original plant cover in a particular area, region or country. If it is not native, it is introduced.

Sometimes categorizing a plant is very difficult. Some species of plants are so similar in appearance that they may be hard to tell apart. However, there are many different parts to a plant, and not all of them will be the same. Grass plants, for example have many different

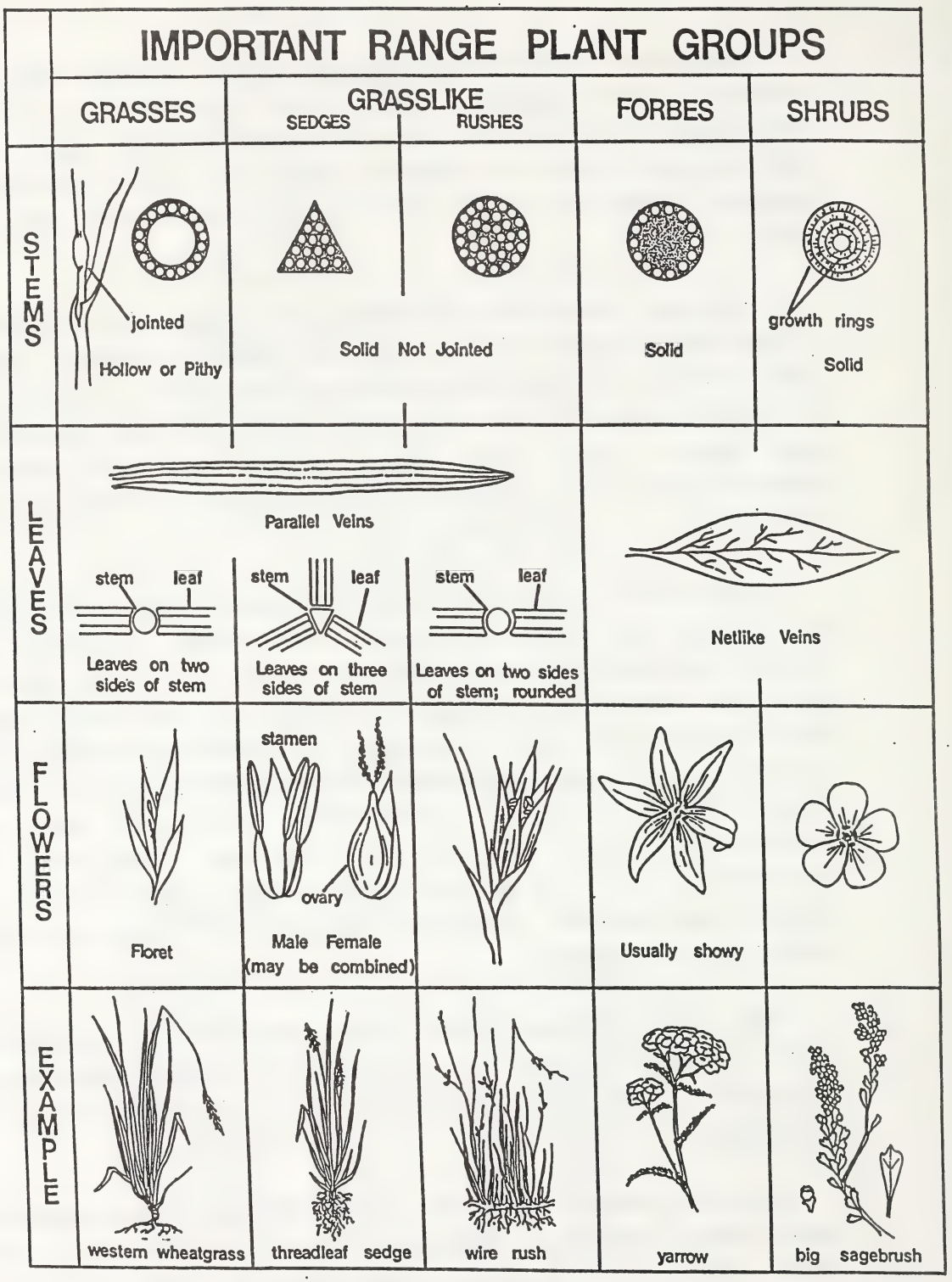


Figure 2. Plant groups based on the form of the plant.

parts which can be used to distinguish each species (Figure 3). Botanists and taxonomists have recorded these differences after examining thousands of different plants. They have organized this information into books and tables referred to as plant keys. Figure 4 is an example of a plant key. Note that the names of the plant are botanical names, not the common names with which you may be familiar. Because there may be more than one common name for a plant (for example speargrass and western porcupine grass) botanists have given each plant one botanical name which is registered all over the world.

The Grass Plant

Rangelands have many different kinds of plants, but the most important is grass. All cereal crops are grass plants, as are most forage crops for livestock. A basic knowledge of grass growth and development is necessary before any range management plan can be successful.

During the growing season a grass plant goes through at least two growth phases: a vegetative phase and a reproductive phase (Figure 5). Growth begins early in the season from small buds on the crown of each plant. Each bud develops a shoot, or tiller with four or five leaves. The bud stays near the crown of the plant (often below the soil surface) through the tillering stage. Eventually the bud begins to grow, elevating itself above the surface of the soil. This is the jointing stage of development and it is the last stage of vegetative growth. Soon a seedhead begins to form and the stem of the plant elongates. The seed head is said to be 'in the boot' because it is tightly enclosed and protected by the uppermost leaf. The boot stage is the first of the reproductive growth phase. Eventually the seed head emerges and the plant is said to have 'headed out'.

All this growth is made possible because the plant manufactures its own food. The leaves and stem use sunlight, air and water to make carbohydrates, the basic plant food. These materials are then used to grow new leaves, roots, stems and so on.

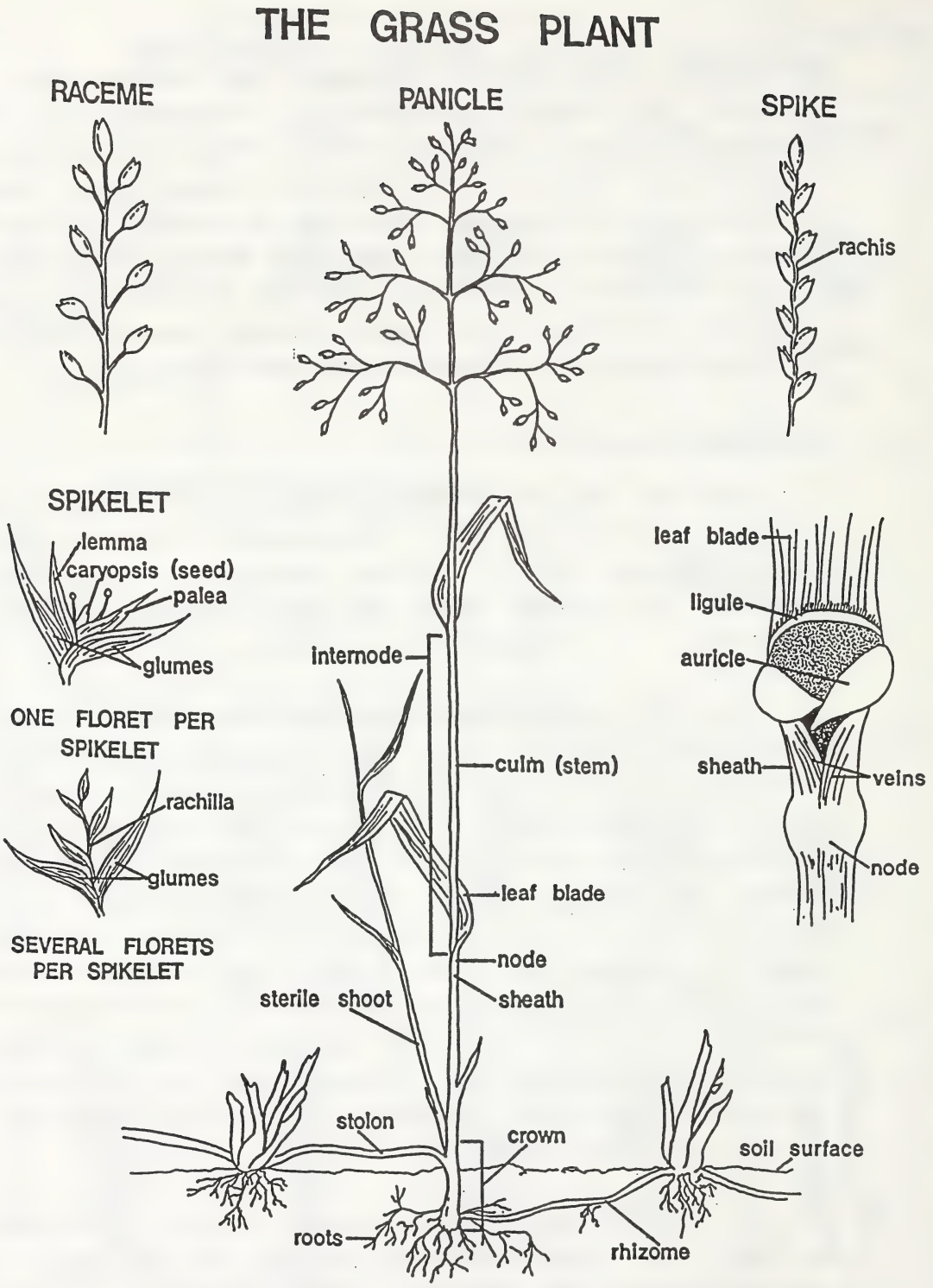


Figure 3. Parts of the grass plant used for identification.

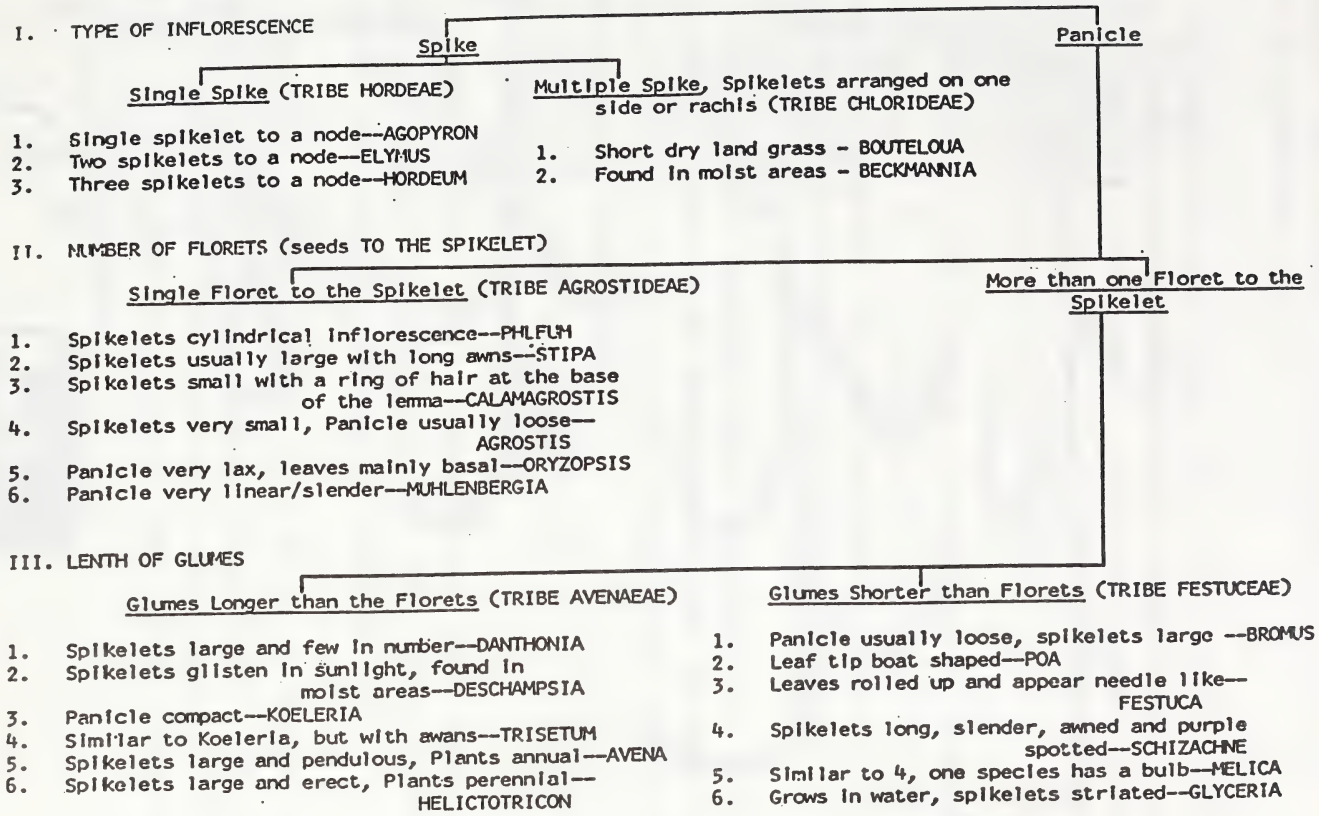


Figure 4. Key to the tribe and genus of common range grasses of Alberta.

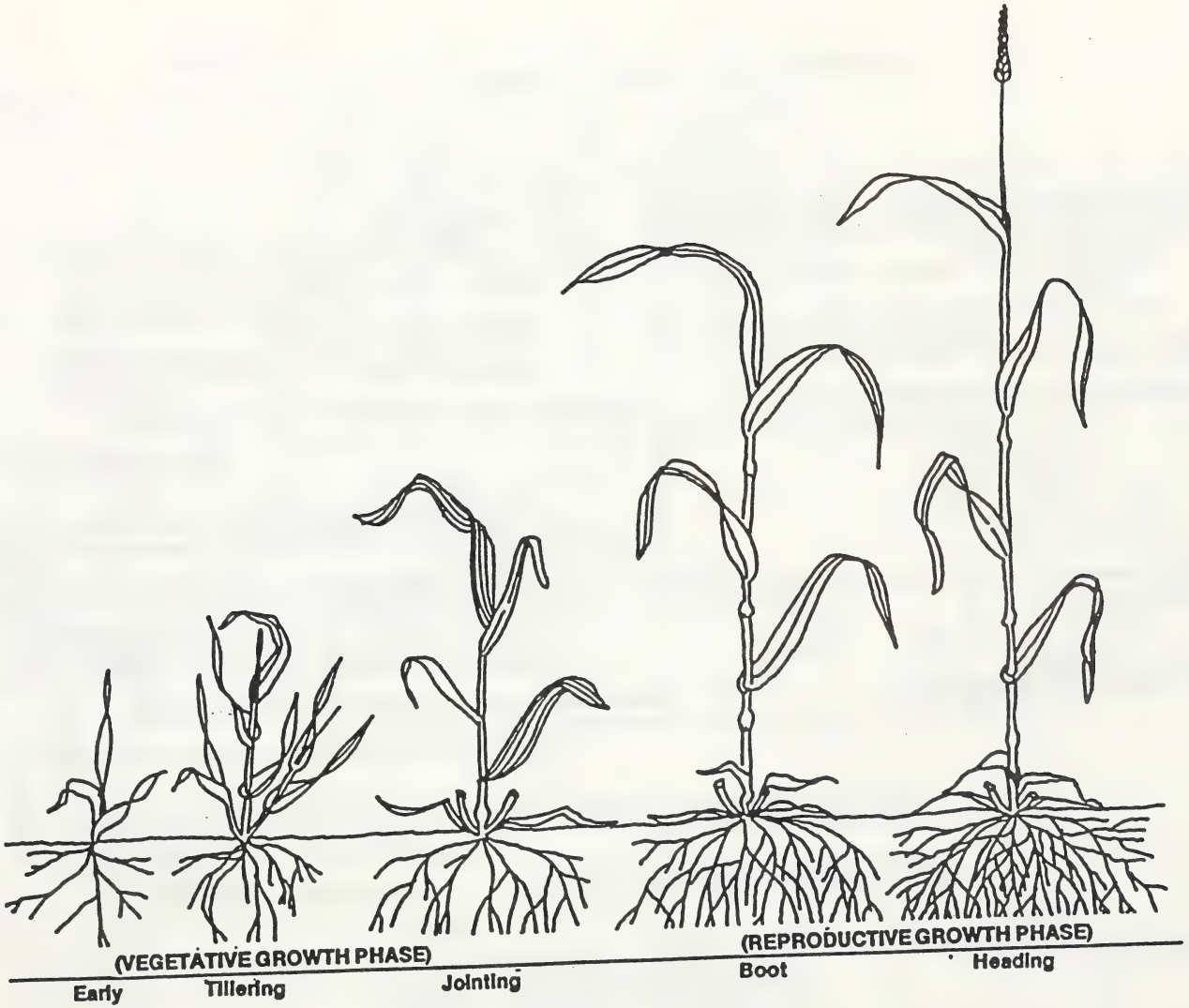


Figure 5. Growth and development of a grass shoot.

Annual grasses store some carbohydrates in the seed as food reserves. These reserves can then be used to grow the first leaves and roots of a new plant.

Biennial or perennial grasses store food reserves in the roots and crown. These reserves are used whenever the leaves cannot supply enough food to meet the plant's needs. In the spring the plant must depend on stored reserves to grow new leaves, but the reserves are also used in the summer when the seed is being produced.

The amount of food in storage tends to cycle up and down throughout the year (Figure 6). In the spring the reserves decline as the plant produces new foliage. The reserves generally peak in the fall just before the plant goes dormant for the winter.

The two most important factors affecting the amount of food produced and stored are the amount of water and the number and size of leaves. Drought and leaf removal or defoliation sharply reduces the amount of carbohydrates produced.

Grazing Animals

Grazing animals affect rangelands in three major ways: by defoliating plants, trampling plants and soil, and by defecation. The range and individual plants respond in observable ways.

Some plants respond to grazing by dying, or at least they do not grow as vigorously. Perhaps repeated defoliation does not allow them to produce enough food, or their buds are removed so they cannot reproduce. These plants are known as decreasers: they are not tolerant of grazing.

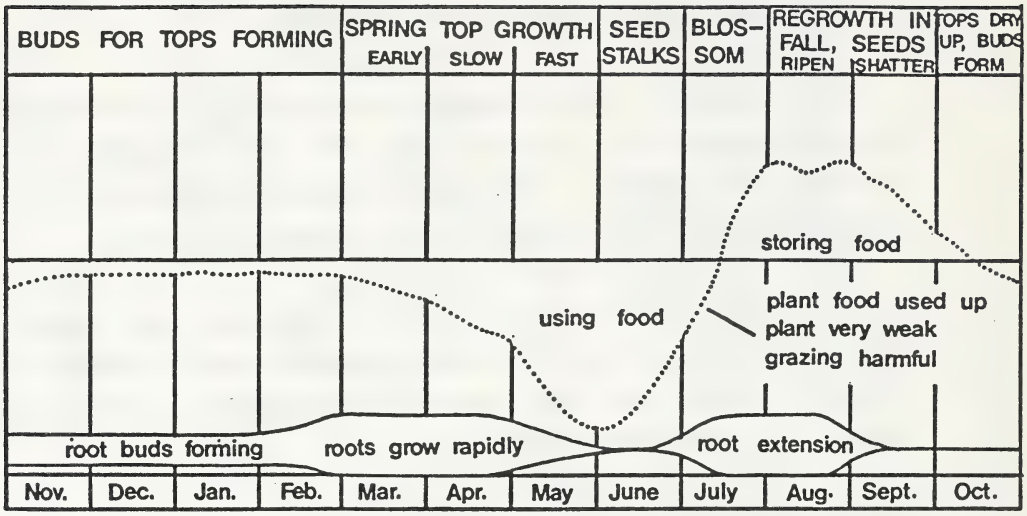


Figure 6. Annual cycle of use and storage of plant food reserves.

Other plants respond to grazing by growing more vigorously or more abundant. Perhaps they are unharmed by defoliation, or they may compete more successfully with decreasers for light, water, or nutrients. These plants are known as increasers: they are tolerant of grazing. If grazing has been very severe, even the increasers may be harmed, allowing other non-native, alien plants to compete with the increasers and decreasers. These plants are called invaders; they are often weeds or introduced plants.

Whether a plant is a decreaser, increaser or invader depends on two things: 1) the plant's ability to remain unaffected by grazing; and 2) the grazing animal's preference for that plant.

Grazing animals have preferences and regular patterns of behaviour. For example, cattle are usually seen grazing in the morning and evening, and resting at midday. They may prefer one area for grazing and another for resting. Their daily routine is not random; they select each area based on their needs and preferences.

Plants are selected in much the same way. Certain plants are preferred because they are more palatable or plentiful than other plants.

Range Condition and Carrying Capacity

Range in the best condition has an abundance of the most palatable and nutritious plants. Many of these plants are decreasers; they will be selected by the animals everytime they graze. Without proper management these plants will decrease in the stand. Range plant communities which are at the climax stage of succession are often in excellent range condition.

Range in excellent condition has a limited capacity to support grazing animals. This capacity to carry livestock or big game is based on how much grazing can be tolerated and still maintain the original plant community. Historically, the carrying capacity was often exceeded because too many head of stock were allowed to graze the range. Repeated defoliation resulted in stands which were no longer climax and were in less than excellent condition.

By experience we have learned to judge the condition of the range by comparing the proportion of decreasers, increasers and invaders in the existing stand with those in the climax stand (Figure 7). We then rate the stand on a 4-point scale of poor, fair, good, to excellent condition.

Once we know the condition of the range we can estimate its carrying capacity. We can make decisions to keep or change our rate of grazing and incorporate them in our plan.

Stocking Rate and Allowable Use

If we know the carrying capacity of a range, we know, approximately, the maximum number of animals which the range could support in a grazing season. However, we may not wish to stock at this rate. We may wish to use only a portion of the available carrying capacity so as to reduce overgrazing or to improve the condition of the range. The stocking rate is the number of animals we choose to graze on an area of land for a specific period of time. We can set the stocking rate above, at, or below the carrying capacity.

In our plan we must decide what use we should allow and then we set the stocking rate. If we set the allowable use higher than the carrying capacity, stocking rates will result in over-utilization for that grazing season. Continually setting the allowable use too high will result in poorer range conditions, and poorer seasonal performance in our animals.

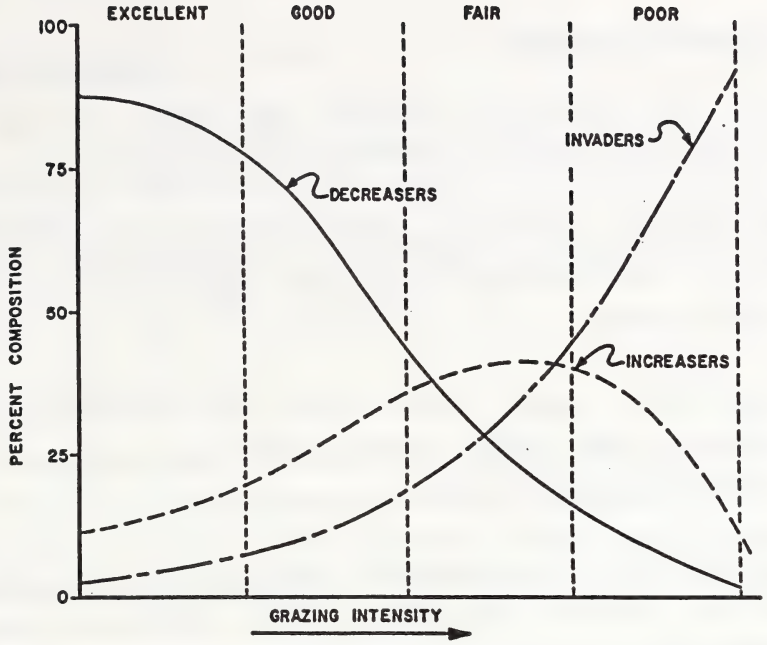


Figure 7. The proportion (composition) of decreasers, increasers and invaders on range in excellent, good, fair and poor condition.

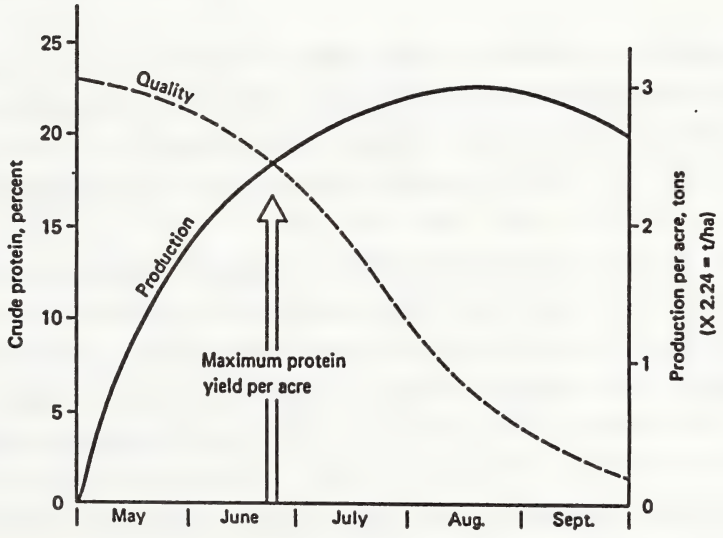


Figure 8. Relationship between forage yield and forage quality.

Nutrition of Grazing Animals

A number of factors can influence the quality and quantity of available forage, and affect the performance of animals.

Over-utilization and over-grazing forces the animals to eat lower quality forage. Under-utilization, on the other hand, may allow the animal to waste forage.

Grazing animals usually prefer leafy material over stem, green tissue to mature, dead forage. These preferences usually give diets that are higher in nutritive value.

Plants which are in the vegetative phase of growth generally have a higher level of nutrition than plants in the reproductive phase. As plants mature they become coarser, and their food value or quality decreases (Figure 8). This leads to one of the major problems in grazing: the average forage quality on many ranges and pastures is insufficient to support high levels of livestock production all year round.

Several strategies have been developed to compensate for the nutritional inadequacy of range and pasture. The most common strategy is to allow the animals to choose their own diet. This often results in poor animal performance in the late part of the grazing season when there is very little green material left. At this stage some livestock producers will feed supplements. Another strategy is to force the animals to graze all the forage available throughout the grazing season. If done properly this can keep most plants in the vegetative growth phase throughout the grazing season. However, the range and pasture can be seriously over-grazed if this procedure is carried on too long. A final strategy is to cut hay at the point in the season when both quality and quantity are greatest. This material is then stored and fed as silage, greenfeed or hay.

RANGE MANAGEMENT

With our knowledge of range ecology we can begin the process of planning the management of our range and pasture. Initially we require information on the kind and amount of plants, and on the distribution of animals and the effects of their use. In other words we must conduct an inventory of our range and pasture.

Range Inventory

Using a number of standard scientific measurements we can rapidly evaluate any range or pasture. We need to measure at least three things: abundance of each plant species, production of forage, and the distribution of animals.

The abundance of each plant species is determined by estimating the number of plants of each species in a given area. The relative size of each plant or the area it covers is also in estimate of abundance when compared with other plants.

The production of forage is determined by cutting a sample from a known area (1 square yard, or 1 meter squared for example). The sample is then air dried, weighed and the weight per unit area is recalculated in terms of the weight per acre or per hectare.

The distribution of animals is estimated by mapping their use of the range. A scale drawing of the range is prepared. The observer then goes out on the range and marks areas on the map which have been used by animals. Table 2 lists the classes of use. Figure 9 is an example of a typical pattern of animal use on.

Once we have inventoried the range we can decide how to maintain its value or improve its production. In other words we make plans about how to manage it and conserve it.

Table 2. Use Classes for Estimating the Degree of Utilization and Animal Distribution on Pasture.

Use Class	Degree of Use	Description
None	0 - 15%	Very little or no use of key forage plants.
Light	16 - 35%	Key forage plants lightly to moderately used. Practically no use of low-value forage plants.
Safe	36 - 65%	Key forage plants used moderately to well for the season and site involved. Some use of low-value forage plants.
Heavy	66 - 80%	Key forage plants closely cropped. Low-value forage plants grazed moderately to heavily. Evidence of trampling damage.
Severe	Over 80%	Key forage plants grubbed. Low-value forage plants closely cropped. Trampling damage obvious.

Range Management Planning

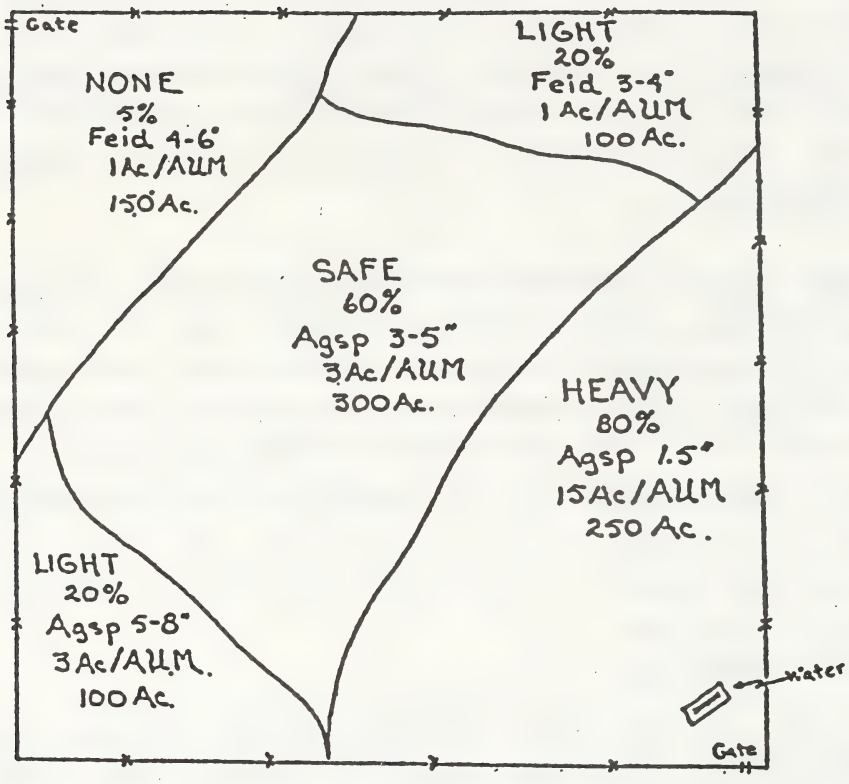
A management plan is simply a statement of the way things are to be done. The objectives of the plan are stated as well as the way each objective will be accomplished. For example, an objective could be to lower the degree of use from heavy to safe on the southeast corner of the pasture in Figure 9. This could be accomplished by putting water in the northwest corner, by splitting the pasture in half with a fence, or by some other means.

Once a list of objectives have been created they are ranked in order of priority. Each objective is rated so that the list has an order. The most important objective will be first, least important, last. The plan is then complete and it is up to the range manager to put it into effect. The plan should be continuously updated as each objective is accomplished, or as the need for new objectives become evident.

Animal Distribution

A great deal of range management involves handling animals. Efficient range and pasture use can only be achieved if the animals are distributed evenly, if they are healthy, and if they have enough to eat.

Water is the single most important consideration for animals. Adequate supplies at convenient locations can do more to distribute livestock than anything else. Salt is also required by stock and can be used to help distribute stock on the range. Other factors which have a significant effect on livestock distribution are feed supplement stations, insect control, riding or herding, trails and fences.



LEGEND: SAFE – Use class
60% – % use of key species
Agsp 3-5" – Key species – stubble left
3 Ac/AUM – Estimated initial stocking rate for use zone
300 Ac – Size of use zone

Figure 9. Sketch map of a 1,000-acre pasture illustrating a typical pattern of animal use.

Grazing Systems

A grazing system is a scheme or procedure for grazing animals on pasture or range. A grazing system may be quite simple or may be very elaborate.

Grazing systems are meant to achieve any of a number of objectives in a range management plan. The objectives most commonly set for simple grazing systems are: 1) to achieve an even distribution of animals or more uniform grazing patterns; and 2) to give the range a periodic rest so the plants can reseed and replenish their food reserves. Some of the objectives of more elaborate grazing systems are: 1) to schedule maintenance and improvements into the grazing schedule; 2) to confine the animals for increased breeding efficiency or disease control; 3) to extend the grazing season; and 4) to increase the production of beef per acre.

The simplest and most common grazing system is continuous grazing. Livestock are placed on one pasture and graze there for the full grazing season. Continuous grazing has a number of advantages including minimum handling of livestock. Livestock gains are usually good with little overhead or risk. Its disadvantages are that the pasture is used unevenly, resulting in over use of deterioration in some areas and no use in others. Also, the preferred and most nutritious plants are often grazed out.

Other grazing systems usually involve some kind of rotation. The grazing season, the pasture, or the herd is broken into two or more units. Each unit is grazed in rotation according to a grazing schedule written into the plan. The advantages of rotational grazing systems include improved livestock distribution, greater livestock production per acre, and improved range condition. The disadvantages include higher costs, and pastures which are very sensitive to stocking rate changes. Sometimes the only way we can improve the range or pasture is by using rotational grazing systems.

Range Improvements

Range improvements are those management practices which are aimed at increasing the production or utilization of range and pasture. There are a large number of things that can be done. The most costly is clearing, breaking and seeding the range to a more productive variety of forage. The least expensive is prescribed burning which removes old, dead growth and controls certain plants. In between are a variety of things including weed and poisonous plant control, fertilization, water development, fence construction, and erosion control. All improvements should be carefully considered before they are incorporated in the range management plan.

Selected References

		Available
1.	Stoddart, L.A., Smith, A.D., Box, T.W. 1975. RANGE MANAGEMENT	Library
2.	Walton, P.D. 1981. PRODUCTION AND MANAGEMENT OF CULTIVATED FORAGES	Library
3.	Johnston, A., Wroe, R.A., Smoliak, S., Yale, D.A. 1981. RANGE, ITS NATURE AND USE. Alberta Department of Energy and Natural Resources	Free
4.	Wroe, R.A., Turnbull, M.G., Smoliak, S., Johnston, A. 1981. GUIDE TO RANGE CONDITION AND STOCKING RATES FOR ALBERTA. Alberta Department of Energy and Natural Resources	Free
5.	Johnston, A., Smoliak, S., Wroe, R.A. GRAZING SYSTEMS FOR ALBERTA RANGES. Alberta Agriculture, Agdex 134/14	Free
6.	GRAZING TAME PASTURES EFFECTIVELY. Alberta Agriculture, Agdex 130/53-1	Free
7.	VARIETIES OF PERENNIAL HAY AND PASTURE CROPS FOR ALBERTA. 1985. Alberta Agriculture, Agdex 120/32	Free
8.	M. Bjorge, PASTURE AND RANGE MANAGEMENT FOR ALBERTA. Agdex 134/14-6	Free
9.	Johnston, A., Smoliak, S., Wroe, R.A. PRINCIPLES OF PASTURE MANAGEMENT. Alberta Agriculture, Agdex 130/10-1	Free
10.	Smoliak, S., Wroe, R.A., Johnston, A. ALBERTA RANGE PLANTS AND THEIR CLASSIFICATION. Alberta Agriculture, Agdex 134/06	Free

COMMENTARY OF

RANGE MANAGEMENT SLIDES

1. A typical range. It is a wide open country. You can visualize the difference between a pasture and a range. In a range the area is very large, soil is not arable, very little fencing and you find beef cattle.

2. A Range in good condition. Soil seems to be good because you can see good growth of plants. Vegetation is thick and soil seems to be well covered. Vegetation appears to be mainly of palatable, perennial grasses. The individual plants appear to be robust. In other words, the condition of the soil is good, plant density or cover is good, plant composition is good and plant vigour is good. These are the four major factors used in our score card to judge the condition of the range.

3. A fence line contract. Here you see the difference between the grazed and ungrazed area.

4. A range in poor condition. You see a large portion of the area is fully exposed with no vegetation at all. A large amount of bare ground can be very critical and easily subject to erosion. Poorer vegetation can be expected in such areas. The size of the plants can indicate the poor vigour of the plants. When the range condition comes down to this stage, we have to take very active or drastic steps to bring it back to the original good condition.

5. Vigour of the plants. The plant is the same on either side. It is June grass. On one side you see three single plants with roots and one stem. On the other side there is one single plant showing good vigour. Vigour can be judged by the size or the thickness of the clump, the height of the plant, the size (length and width) of the leaves, the number of seed heads. What you do not notice in composition alone, you can observe in vigour. So all factors should be considered together and not individually.

6. Effects - invisible. Some of the bad effects of improper grazing cannot be seen unless you make an effort to dig up the plants. Overgrazing and grazing from the very early season when the plants are not ready can cause this effect - poor development of roots. When there is poor growth of roots, we can expect poor growth of plants in the succeeding seasons. You can note that the poorest development of root is obtained where the grass is grazed close to the ground not leaving the crown portion. The one in the middle shows moderate grazing; the crown portion, (which along with the root stores food in reserve for the future plant) is left ungrazed. At the end of the grazing season, we should see that a decent amount of carryover is left to bring forth vigorous plants the following year.

7. This is Tall Larkspur (Delphinium scopulorum). Note the leaves are alternate in contrast to geranium where the leaves are opposite. The stem is hollow, unlike geranium stem. Consumption of this plant equal to 0.1% or more of the body weight of this animal is fatal. This is mainly poisonous to cattle and not to horses and sheep. Affected animals may be saved if a subcutaneous injection of Physostigmin salisylate 1 grain, Pilocarpin hydrochloride 2 grains and strychnine sulphate $\frac{1}{2}$ grain dissolved in water is given immediately. This is not always possible and so it is easier to avoid larkspur poisoning by other methods. Delayed grazing will allow this plant to grow much taller than grasses and the cattle are likely to avoid this. Feed your cattle with an extra dose of phosphorus among your minerals during the winter months. Feed your cattle for the first few days with hay and minerals when they first enter the range. This will lessen preverted appetite. Root out the plants by mechanical or chemical means.

8. This is water hemlock (Cicuta maculata), a poisonous plant of the wet or moist areas. The leaves are bi- or tri-pinnately compound. The basal portion of the stem and tuberous roots show partitions when cut open. The plant is poisonous to all livestock. All parts of the plant are poisonous and a small tuber is enough to kill a cow. The plant should be avoided by fencing it off or be eradicated by grubbing out the roots. Very little can be done to cure the affected animals. A drench containing potassium permanganate 1 gram and aluminu, sulphate 1 gram may give some beneficial effect.

9. This is Arrow Grass (Triglochin maritima). This is not a grass, but looks like one with spongy round leaves. The inflorescence appears like a spike. The plant grows near marshy areas and saline flats. All parts of the plant are dangerous at all times. It is poisonous to cattle and sheep. When the ground is frozen or when a wet meadow dries up, animals have easy access to this plant and losses may be heavy. It is not very common in the forest area. The plant contains hydrocyanic acid. Affected animals show muscular spasms, chomping of the jaws and hard breathing. There is no sure treatment and the poison is an extremely quick acting one. Corn syrup drenches can be tried. Intraperitoneal injection of 2 grams of sodium thiosulphate and 1 gram of sodium nitrate in a 20% water solution is recommended. Heavy salting, careful herding and fencing worst areas would prevent cattle losses. The plant contains a high percentage of salt, making the plant quite palatable, hence heavy salting is recommended.

10. This is Death Camas (Zygadenus gramineus). This is mainly poisonous to sheep, even though cattle and horses may be affected to a small extent. This is found mainly in the prairie region. Unlike bronze bells and smooth camas which are not poisonous, this plant has the flowers bunched up at the tip of the inflorescence. This occurs generally in overgrazed areas. Affected animals should be kept quiet and provided with good feed and water. If available, "Death Camas Tablets" may be given.

11. This is Lupine (Lupinus argenteus) and it is mainly poisonous to sheep. Even in the dry hay it is poisonous and the seeds contain more poison than in the other parts of the plant. No method of treatment has proved successful. Cattle may be used to graze lupine infested areas. Sheep may be kept off the area at least during the pod-bearing season.

12. This is Woolly or Purple Loco weed (Astragalus mollissimus). This is one of the loco weeds which belong to the genera Astragalus and Oxytropis. This is mainly poisonous to horses, but cattle and sheep can be affected. No antidote is uniformly satisfactory. For horses, Fowler's solution of arsenic in doses of 2 grams twice per day in water or mash is suggested. For cattle, hypodermic does of 1/5 grain of strychnine inserted in the shoulder daily for a 30-day period is recommended. Sheep should be put on good nutritive diet and a dose of 4 ounces of magnesium sulphate would assist.

13. Multiple use of Forest Land. From the forest land we get water, timber, forage, recreation and wildlife. All these resources can be made use of in the same place and at the same time provided there is no conflict. Resources are to be used, but very judiciously and that is conservation. Locking up the resources by non-use is not conservation. Use should be made carefully so that the benefit or the enjoyment can be obtained perpetually or on a sustained yield basis. At all times, water should be considered as of prime importance. The use of timber and forage can go hand in hand in the same place at the same time. However, where reforestation programs are goind on, livestock grazing should be avoided. Except elk, most of the big game animals do not compete so much for the same forage with cattle. They are mainly browsers. Some people do not like the presence of livestock near the recreation areas. If necessary, livestock can be taken away from such areas. Avoid conflicts between the different uses. Money is not all in all the final criterion.

SOIL

CONSERVATION

"We have not inherited
the soil from our
fathers, we are
borrowing it from
our children."

Notes prepared
and
Lectures given by:

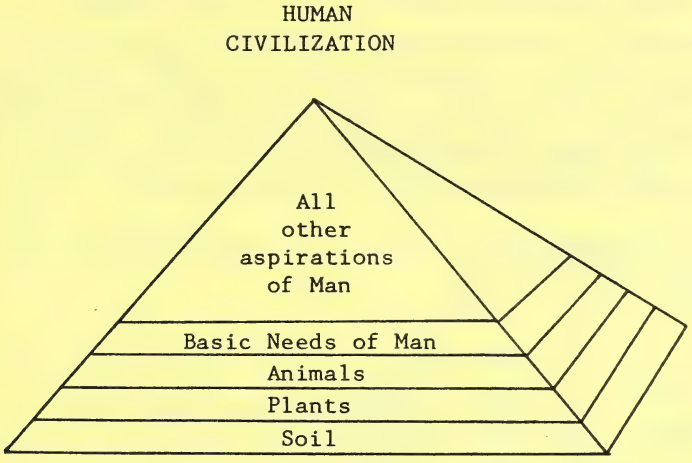
College Staff
OLDS COLLEGE
Olds, Alberta

SOIL CONSERVATION

INTRODUCTION

WHY IS SOIL CONSERVATION IMPORTANT?

To answer this question, the very essence of life must be considered. The soil forms the foundation of the pyramid of human life. Directly or indirectly, the soil is our source of food, clothing, shelter, and ultimately, all the aspirations of man.



PYRAMID OF HUMAN LIFE

Upon each layer a basic human need is built. At the apex stands the cumulative result--human civilization. If the bottom layer should disappear, the whole pyramid would fall and our civilization would collapse.

We have only to look at history to discover the reality of soil's importance at the base of human civilization. Recent studies have shed new light on the root causes of the collapse of early civilizations.(3) The Mayan civilization in the lowlands of Guatemala was at its agricultural, cultural and architectural peak when it suddenly collapsed. Due to increased population pressures, soil erosion increased at alarming rates, and one of the world's early civilizations was robbed of its sustenance. The rise and fall of most great civilizations of the past has been dependent upon the use and misuse the civilization has made of the soil. Whenever a civilization has made good and wise use of the soil, it has prospered. As soon as the soil was misused, the civilization began to collapse. Hence, one by one, the great civilizations of the past were undermined by soil degradation.

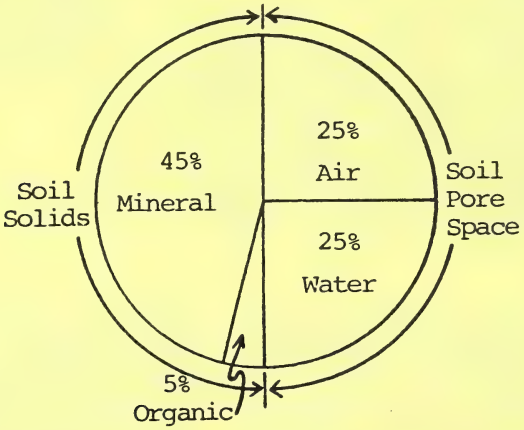
As we build new civilizations on North American land, we are mismanaging the soil to the extent that it is being degraded at an alarming rate. The question has been asked, "If environmental stresses undermined earlier civilizations, whose population doubling times were measured in centuries, what is their impact now when population doubling time is measured in decades? . . . Does this comparison suggest that the Mayan's legacy is our own?"(2)

Our hope lies in the fact that our managerial elite are not blind to the environmental stress signs of our times. What are these warning signs? What are the key soil conservation issues? What action is being taken?

Before answering these questions and exploring the major soil conservation issues on the Canadian prairies, it is essential to look at some basic soil concepts. These are discussed below.

WHAT IS SOIL?

Soil is the naturally occurring, unconsolidated, mineral or organic material at the earth's surface that is capable of supporting plant growth. Soil covers the surface of the earth like the peel of an orange covers the orange, except that the soil varies considerably from site to site on the earth's surface. The soil is comprised of mineral and organic materials and the pore space is occupied by air and water. The volume composition of an "ideal soil" is as shown below:



Volume Composition of an Ideal Soil

1. Mineral Constituents of Soil

The mineral matter of soil is composed of small rock fragments and minerals of various sizes and kinds. These components are classified into various sizes as follows:

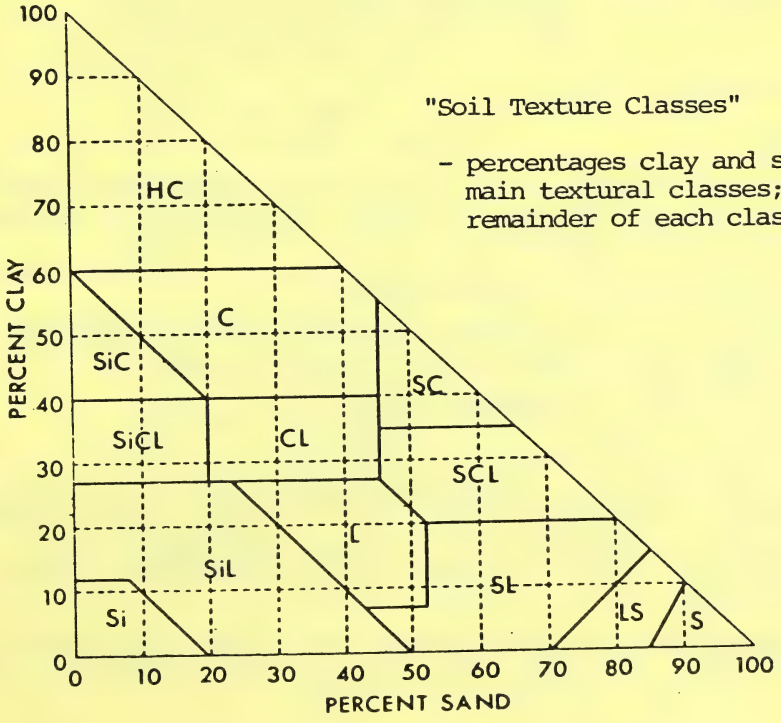
sand - particles ranging from 0.05 mm to 2 mm in diameter;
silt - particles ranging from 0.002 mm to 0.05 mm in diameter;
clay - particles less than 0.002 mm in diameter.

The proportion of these components — sand, silt, and clay — in a particular soil is referred to as its "texture".

Terms used to describe soil texture:

General Terms		Soil Texture Class	
		Name	Symbol
Sandy soils	(coarse textured soils)	Sand	S
		Loamy sand	LS
	(moderately coarse textured soils)	Sandy loam	SL
		Fine sandy loam	FL
Loamy soils	(medium textured soils)	Very fine sandy loam	VL
		Loam	L
		Silt loam	SiL
		Silt	Si
	(moderately fine textured soils)	Clay loam	CL
		Sandy clay loam	SCL
		Silty clay loam	SiCL
Clayey soils	(fine textured soils)	Sandy clay	SC
		Silty clay	SiC
		Clay	C
		Heavy Clay	HC

Soil Textural Triangle



"Soil Texture Classes"

- percentages clay and sand in the main textural classes; the remainder of each class is silt.

The texture of a soil largely determines its "physical and chemical properties."

Sandy soils:

(a) are called light because they are loose and easily worked;
(b) have a low moisture-holding capacity and a high infiltration rate;
(c) are subject to drought;
(d) have low fertility;
(e) are easily eroded by wind.

Clayey soils:

(a) are called heavy because they are tough when dry and very sticky when wet and are often hard to work;
(b) have a high moisture-holding capacity and a low infiltration rate;
(c) have a high fertility;
(d) are easily eroded by water, particularly on steep slopes.

Loamy soils:

(a) are intermediate in physical and chemical properties between sandy and clayey soils;
(b) provide a good environment for most agricultural crops.

The arrangement of the soil particles into larger units such as granules, columns, blocks, etc., is referred to as soil structure. Structure is important in soil for good growth and control of soil erosion. Structure is dependent upon the amount of sand, silt and clay (texture), the amount of organic matter and the kinds of salts present in the soil.

2. Organic Constituents of Soil

Organic matter:

(a) is any material which was once plant or animal and has not been completely decomposed into simple chemical elements such as hydrogen, carbon, oxygen, sulfur, phosphorus, etc.;
(b) is the remains of cereal and forage crop roots, straw and stubble, legumes (green manure), barnyard manure;
(c) is continually being decomposed by millions of micro-organisms; organic matter is found in all stages of decomposition, humus is highly decomposed organic matter;
(d) must be replenished to maintain supply;
(e) decomposition is speeded up by cultivation;
(f) affects physical and chemical properties:
    (i) promotes good soil structure (aggregate stability) to resist erosion, contributes to higher fertility and moisture-holding capacity to produce higher yields and more organic matter;
    (ii) is the only source of nitrogen in the soil besides legumes and fertilizers.

The amount of organic matter supplied by various crops is shown below:

	Cereals (wheat)	Legumes (alfalfa)	Grasses (fescues)
Total lbs. of roots in upper 2 inches of soil	1100	1900	4400

Grasses can provide up to one ton of organic matter to a soil every year in the form of old roots.

THE FORMATION OF SOILS

Prairie soils were originally ground up rock and minerals much like our subsoil is today at 1 to 2 metres. These materials were deposited by huge glaciers which retreated from the area about 10,000 years ago. Certain factors such as climate, vegetation, topography and man have interacted over time to produce the different kinds of soils found today. Therefore, soil is a product of these factors and the relationship can be depicted as follows:

$$\text{Soil} = \frac{\text{Parent}}{\text{Material}} \times \text{Climate} \times \text{Vegetation} \times \text{Topography} \times \text{Time} \ (\times \text{Man})^*$$

parent materials	- glacial till - glaciofluvial sands and gravels - glaciolacustrine silts and clays - wind-worked deposits - bedrock - organic materials - recent materials (alluvium)
climate	- rainfall - temperature - evaporation - wind
vegetation	- grasses (short, tall) - trees (aspen, spruce, pine)
topography	- landform patterns (hummocky, undulating, ridged) - slopes (level, gentle, steep) - resulting drainage
time	- 10, to 12,000 years - $<$100 years (recent deposits)
man	- favorable - unfavorable

* (man is a factor only where he has modified the natural environment -- his activities are extremely important from the conservation point of view)

The major soil zones of the prairies are shown on the following map. These zones reflect the dominant influence of the factors of climate and vegetation upon soil development in the prairie region. (See Map page 7)

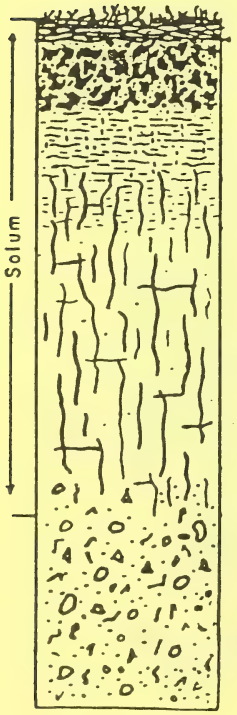
THE SOIL PROFILE

Several processes are involved in the formation of soil from the original parent material. These include:

(a) physical weathering (breakdown) of rocks and minerals;
(b) chemical weathering (alteration, solution) of rocks and minerals;
(c) biological activities of plants and animals (including decomposition of plant remains by micro-organisms); and
(d) transfer of materials from one part of the soil to another.

As a result of these processes, changes occur in the original parent material. Soil layers develop which vary in thickness, color, structure, texture, consistence, as well as chemical and biological composition. The succession of layers (called horizons in mineral soils) from the surface down to the unaltered parent material is called the soil profile. Particular soils are recognized, classified and separated from other soils based on differences in the soil profile. The main or master horizons are designated L, F, H, or O for organic horizons and A, B and C for mineral horizons. Lower case suffixes are used to indicate the type of master horizons. Some examples are given in the following general profile diagram:

Diagram of a Soil Profile



L, F, H - Organic horizon, composed of either raw organic matter (L), partially decomposed organic matter (F), or highly decomposed organic matter (H).

A - Mineral horizon at or near the surface. It may be dark colored due to accumulation of humus [Ah, Ahe] or light colored due to removal of clay, iron, and humus [Ae]. — Topsoil

AB - Transition horizon.

B - Mineral horizon that (1) may have enrichment of clay [Bt] or (2) may be altered to give a change in color or structure [Bm]. Usually the lime and salts have been leached out of this horizon. — Subsurface Soil

BC - Transition horizon.

C - Mineral horizon comparatively unaffected by the soil forming processes operative in the A and B horizons [Ck] except for the process of gleying [Cg] and the accumulation of calcium and/or magnesium carbonates [Cca]. — Soil Parent Material

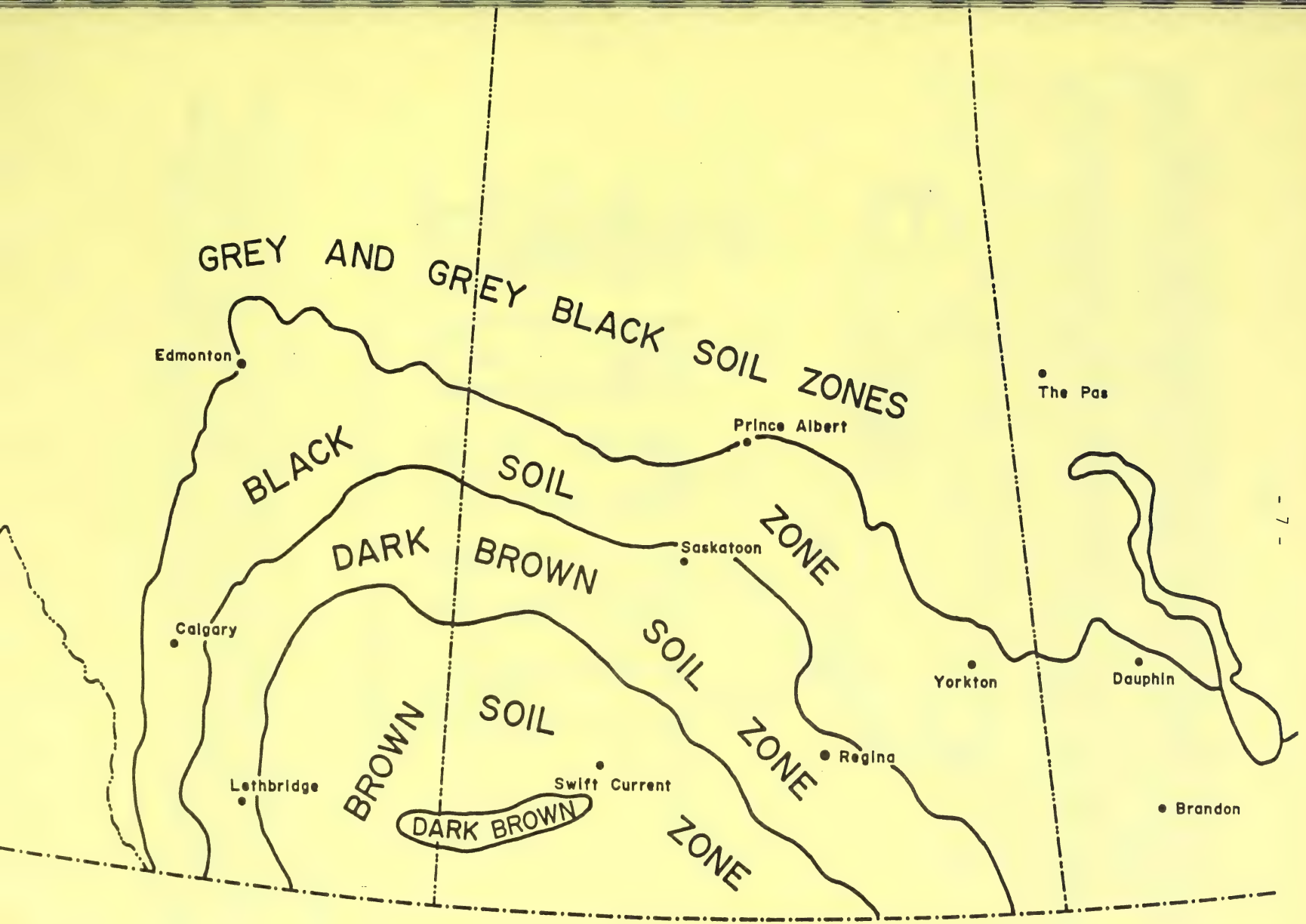
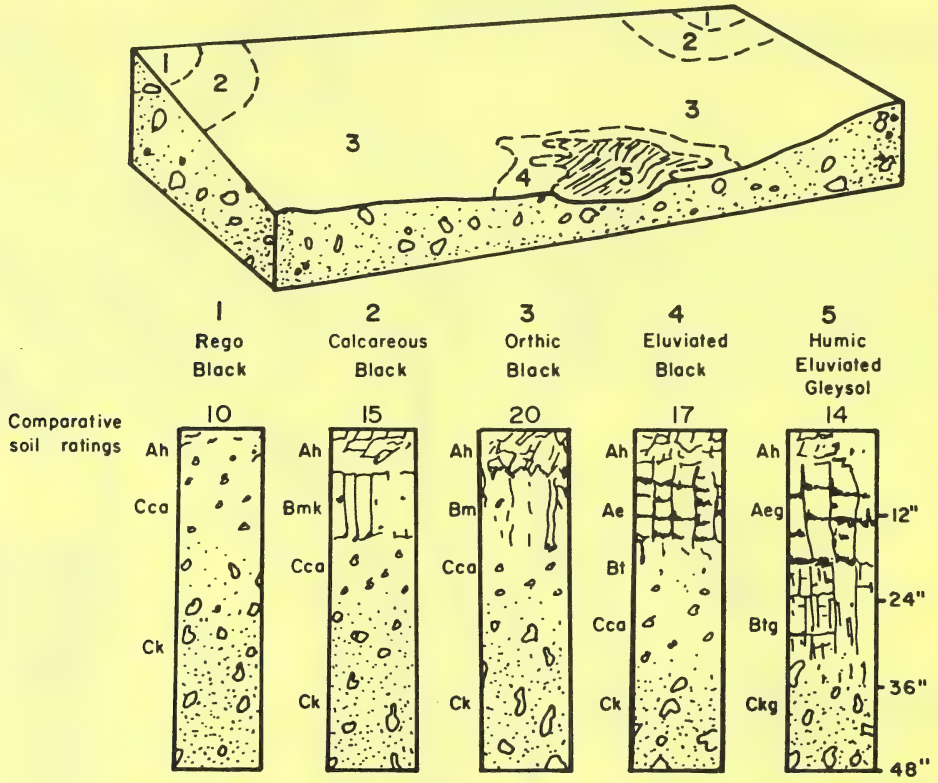


Figure 1. Soil zones of the Prairie provinces.

Many different soils are found on one farm, because when only one factor varies, such as slope, a different soil results. Nevertheless, it should always be kept in mind that the soil is a product of the total effect of all of the soil forming factors.

An illustration of soil variability in one field on a particular landscape is given below. The diagram shows the relationship between topography, drainage and soil type in the Black Soil Zone.



(diagram adapted from Rennie & Ellis, 1978)[10]

SUMMARY

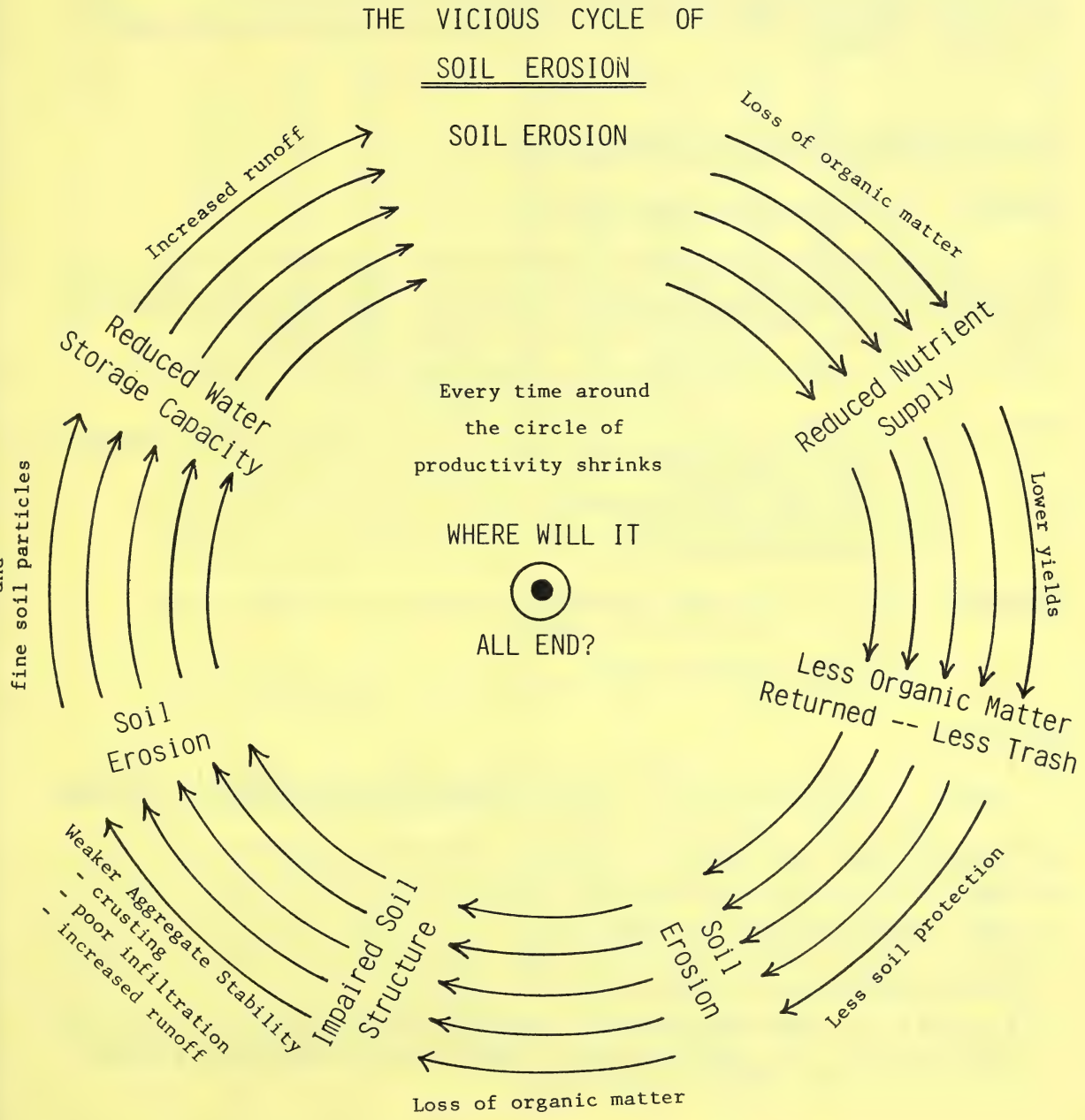
From the above discussion it is evident that the factors which form the nature of soil are physical, chemical and biological. It is necessary to understand these basic properties of soil before steps can be taken to apply soil conservation measures to suit individual situations. Farmers should be familiar with the soils on their own farms so they can implement appropriate soil management practices to conserve the valuable topsoil and keep it fertile and productive.

Soil fertility is defined as the ability of the soil to provide the nutrients and rooting conditions necessary for plant growth. Soil fertility is therefore affected by the supply of available nutrients, acidity, salinity, and soil structure -- both surface and subsurface. Decomposed organic matter -- HUMUS -- has often been referred to as the "seat of soil fertility" since it is the main source and storehouse for nitrogen and serves as food for the many living organisms in soil. It also affects structure, water intake, water-holding capacity and aeration. It is not surprising then that the humus or organic matter level in soil has become the measuring stick for determining the extent to which our soils have deteriorated since cultivation. Since the topsoil is the zone of maximum biological activity and organic matter accumulation, it is imperative that measures be taken to protect it from erosion and contamination. Knowing this, what action is being taken to conserve prairie soils, and what are the burning soil conservation issues of the 80's?

SOIL CONSERVATION ISSUES OF THE EIGHTIES

SOIL EROSION

Soil erosion has been called a creeping death. It took nature upwards of 500 years to build an inch of prairie soil, which may be swept away in a single severe storm. Millions of acres of good land in the prairie provinces have been severely damaged by wind or water erosion caused largely by poor soil management practices.



Characteristics of Soil Most Susceptible to Water Erosion	Characteristics of Soil Most Susceptible to Wind Erosion
- fine textured (silty)	- coarse textured
- poor infiltration	- dry surface
- long, steep slopes	- poor aggregation
- little residue cover	- little residue cover
- Dark Gray and Gray Wooded soils in region of high rainfall intensity	- Brown and Dark Brown soils in region of high wind velocities

METHODS USED TO ESTIMATE SOIL EROSION LOSSES

METHOD 1: The Universal Soil Loss Equation

The Universal Soil Loss Equation was developed to estimate the rate of soil loss by water erosion (sheet and rill) on a specific soil type. The equation includes factors which allows comparison of soil loss rates under different soil management systems. The factors used in the USLE are shown below:

$$R \times LS \times K \times C \times P = A$$

where:
- R = rainfall
- LS = length and steepness of slope
- K - soil erodibility
- C = crop cover and management
- P = conservation practices
- A = the soil erosion loss

Assignment: Given the following information, determine the degree of soil erosion on four assigned slopes:

(a) with vegetation cover;
(b) with vegetation cover removed (as in continuous fallow).

Information:

1. R x LS x K = the amount of soil that would be lost from a particular field segment if it were maintained in fallow condition the year round (cultivated -- no crop grown, -- no surface cover).
2. Rainfall factor (R) = 160.
3. Table - LS factors (see Table p. 13)
4. Soil erodibility factor (K) = 0.4
5. C factor for Rangeland = 0.1
   (undisturbed forest) = 0.01
6. R x LS x K x C = soil erosion from a particular field segment with a specific cropping system (or vegetative cover) without special conservation practices (P) such as strip cropping or contouring.

If the soil loss tolerance level for the soil on these slopes if 4 tonnes/acre/year, what management would you recommend to achieve this goal?

Values of the Topographic Factor, LS, for Specific Combinations of Slope Length and Steepness

Slope (percent)	Slope length (feet)											
	25	50	75	100	150	200	300	400	500	600	800	1,000
0.2 . . .	0.06	0.07	0.08	0.08	0.09	0.09	0.10	0.11	0.11	0.11	0.12	0.13
0.5 . . .	0.07	0.08	0.09	0.10	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.15
0.8 . . .	0.09	0.10	0.11	0.11	0.12	0.13	0.14	0.15	0.16	0.16	0.17	0.18
2 . . .	0.13	0.16	0.19	0.20	0.23	0.25	0.28	0.31	0.33	0.34	0.38	0.40
3 . . .	0.19	0.23	0.26	0.29	0.33	0.35	0.40	0.44	0.47	0.49	0.54	0.57
4 . . .	0.23	0.30	0.36	0.40	0.47	0.53	0.62	0.70	0.76	0.82	0.92	1.01
5 . . .	0.27	0.38	0.46	0.54	0.66	0.76	0.93	1.07	1.20	1.31	1.52	1.69
6 . . .	0.34	0.48	0.58	0.67	0.82	0.95	1.17	1.35	1.50	1.65	1.90	2.13
8 . . .	0.50	0.70	0.86	0.99	1.21	1.41	1.72	1.98	2.22	2.43	2.81	3.14
10 . . .	0.69	0.97	1.19	1.37	1.68	1.94	2.37	2.74	3.06	3.36	3.87	4.33
12 . . .	0.90	1.28	1.56	1.80	2.21	2.55	3.13	3.61	4.04	4.42	5.11	5.71
14 . . .	1.15	1.62	1.99	2.30	2.81	3.25	3.98	4.59	5.13	5.62	6.49	7.26
16 . . .	1.42	2.01	2.46	2.84	3.48	4.01	4.92	5.68	6.35	6.95	8.03	8.98
18 . . .	1.72	2.43	2.97	3.43	4.21	3.86	5.95	6.87	7.68	8.41	9.71	10.9
20 . . .	2.04	2.88	3.53	4.08	5.00	5.77	7.07	8.16	9.12	10.0	11.5	12.9

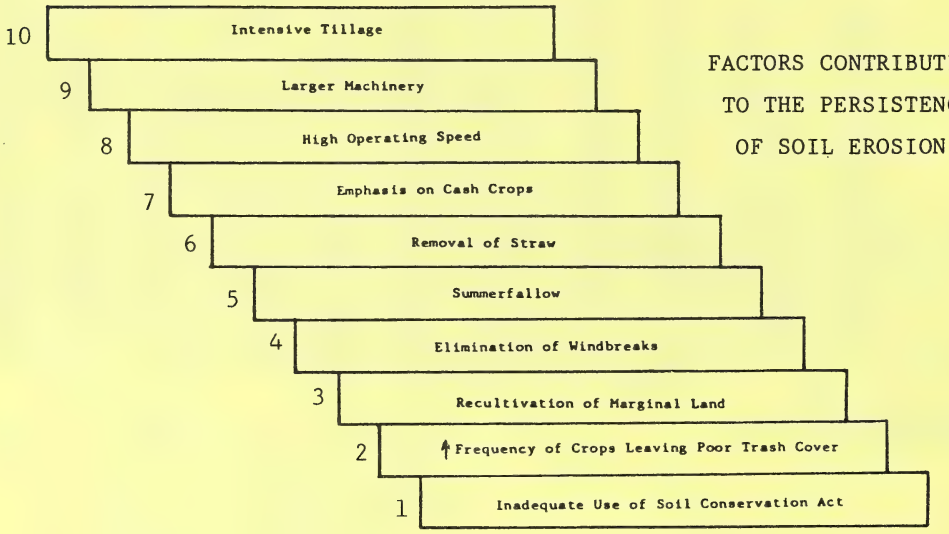
(From Walker and Pope, 1980)[14]

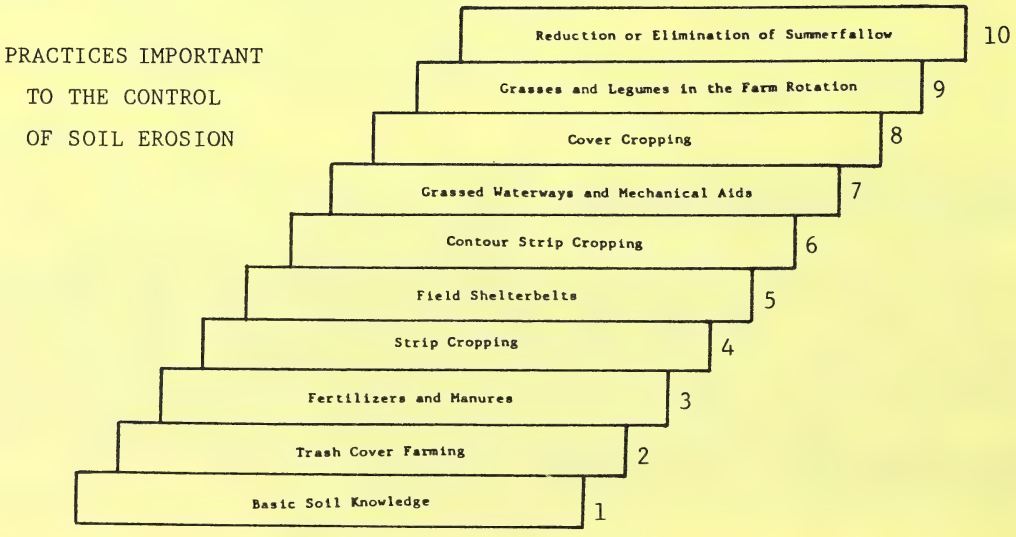
Assignment Calculations:

METHOD 2: The Man-Made Radioisotope - ^{137}Cs

^{137}Cs released in radioactive fallout as a result of nuclear weapon tests in the 1950's and 1960's was fairly uniformly distributed over large regions on the earth's surface. Once deposited, the ^{137}Cs was adsorbed by clay and organic matter and its further movement and redistribution is related to soil erosion. Thus the measurement of ^{137}Cs levels appears to be a valuable procedure in predicting soil erosion and deposition since the 1960's under "modern soil management".[4] It is particularly useful compared to USLE because it measures total gains as well as losses for all agents of erosion -- wind, water, tillage -- on all types of slopes.

Fortunately, the soil management experts in our time are not only aware of the factors which contribute to soil erosion but those practices which will stop the inward spiral of soil degradation and build the spiral outwards to greater heights of productivity.





(Adapted from Holm, 1982)[5]

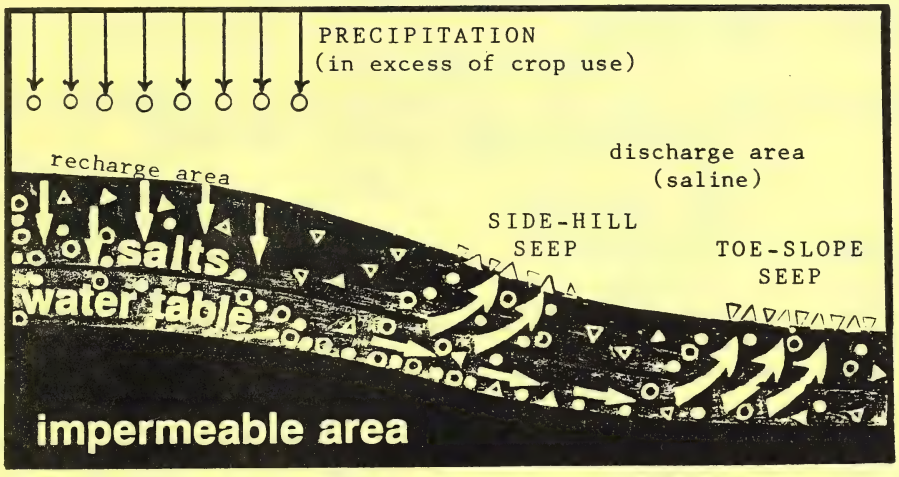
SOIL SALINITY

Soil salinity has been likened to the spread of cancer, killing the productivity of prairie soils. Relatively recent data indicates that about 2.2 million hectares, or almost 4% of cultivated land in Western Canada is affected by dryland saline seepage,[13] and that it is expanding at the rate of about 10% a year.[1] The types of causes of soil salinity are listed below:

1. Side-Hill Seep - caused entirely by man.

2. Toe-Slope Seep - caused largely by man.

SALINE SEEP DEVELOPMENT



(Adapted from Holm and Henry, 1982)[6]

3. Regional Seep - not caused by man but can be aggravated by man.
   - results from regional groundwater movement

4. Evaporitic (bathtub) Ring - aggravated by man
   - occurs around sloughs or drainage ways

5. Irrigation Salinity - directly caused by man.

6. Geologic Salinity - little affected by man.

7. Horse Pasture Salinity - aggravated by man.
   - land cultivated by young farmers with large equipment which was used as pasture by settlers (known to be saline)

8. Quota Book Salinity - aggravated by man.

   - saline land broken to extend to quota base

The impact of this threat to our soil resource and agricultural economy to the year 2000 is shown in the table below. These are only estimates and are based on several assumptions including:[9]

(a) existing area affected on the Canadian prairies is 2.2 million hectares;
(b) annual spread of salinity continues to be 10%;
(c) all area affected is under a crop-crop-fallow system;
(d) value of major crops -- $235/ha;
(e) a 50% yield reduction due to salinity -- $117.50/ha;
(f) costs of production remain unchanged;
(g) no change in wheat prices.

Projected Loss in Farm Income of Farmers in the Canadian Prairies Due to Increase in Soil Salinity 1980-2000[9]

Year	Loss in Income Over 1982 Level ($ million)	Year	Loss in Income Over 1982 Level ($ million)
1983	28.85	1991	232.65
1984	51.70	1992	258.50
1985	77.55	1993	284.35
1986	103.40	1994	310.20
1987	129.25	1995	336.05
1988	155.10	1996	361.90
1989	180.95	1997	387.75
1990	206.80	1998	413.60
		1999	439.45
		2000	465.30
Cumulative 1983-1990	930.60	Cumulative 1991-2000	3489.75

Cumulative Loss 1983-2000 $4.420 billion

MANAGEMENT OF THE PROBLEM

- Soil testing
- Forage crops in the rotation
- Selection of salt tolerant crops
- Interceptor cropping
- Shallow tillage and weed control
- Fertilizers
- Manure
- Drainage and leaching

SOIL ACIDIFICATION

Soil degradation caused by acidification is a relatively recent soil concern on the Prairies. Soils with a pH of less than 6.5 are generally considered to be acid and at pH values below 6.0 yields of cereal, oilseed and forage crops are considerably reduced. The table below illustrates the pH scale and the effect of soil pH on crop growth. Recent surveys indicate that acid soils are much more extensive than originally thought and occupy millions of hectares on the Prairies.[11]

pH Scale	Description	Effect on Plant Growth	Common Substances
	Very strongly acid	Suitable for plants such as blueberries	Beer
5.0	Strongly acid	Yields of alfalfa reduced to ½ or less. Cereals and oilseeds adversely affected.	Squash
5.5	Medium acid	Yields on non-tolerant crops (e.g., alfalfa, sweetclover) affected.	Potatoes
6.0	Slightly acid	Best for growth of most crops.	Fresh corn
6.5	Very slightly acid		Cow's milk
7.0	Neutral-very slightly alkaline		Pure water
7.5	Slightly alkaline		Human blood, egg white
8.0	Medium alkaline	The pH of limestone is 8.3. Soils with pH higher than 8.3 contain sodium	Limestone, sea water

(from Rostad et al, 1983)[11]

ASSIGNMENT:

Using the pH kit provided, compare the acidity of surface soil samples taken from the following areas:

pH

1) under coniferous forest _____

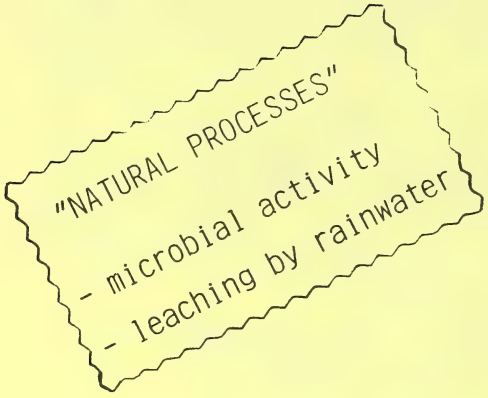
2) under deciduous forest _____

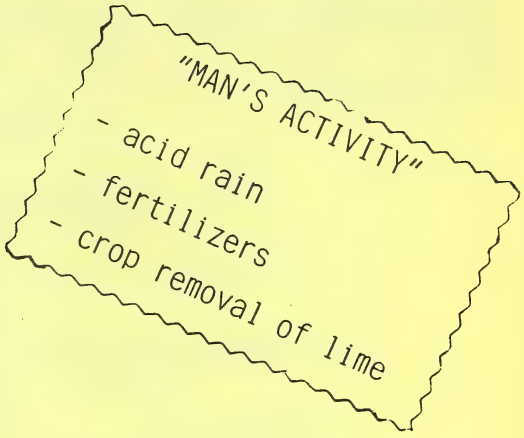
3) from undisturbed rangeland - upper slope _____
- lower slope _____

4) from cultivated farmland - upper slope _____
- lower slope _____

5) East of gas plant (within 1/2 mile) - upper slope _____
- lower slope _____

CAUSES OF SOIL ACIDITY





CONSERVATION MEASURES TO COMBAT AND CONTROL SOIL ACIDITY

"EMISSION CONTROLS"

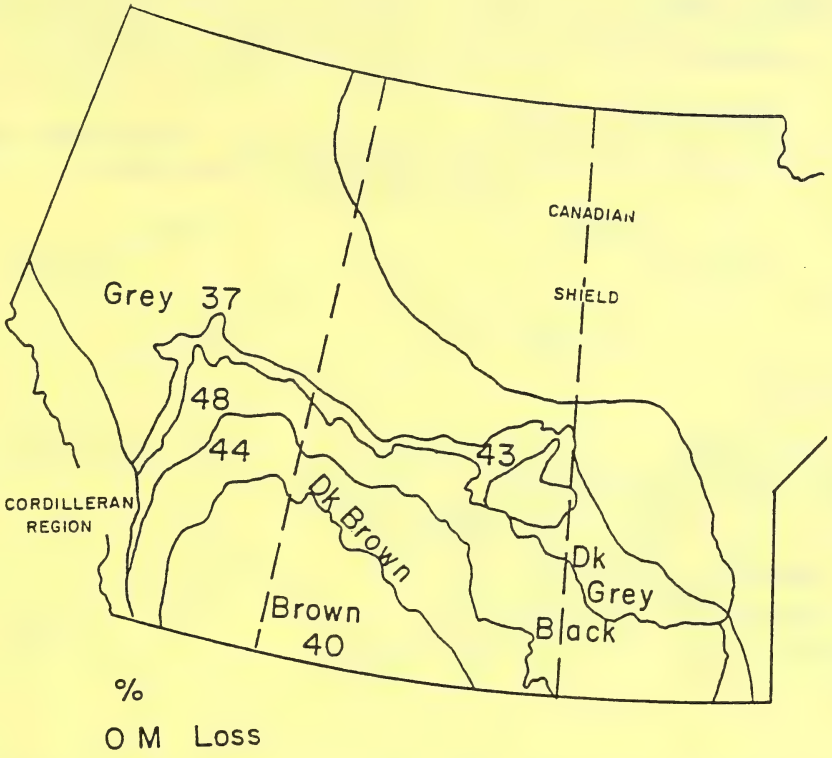
"KNOWLEDGEABLE USE OF FERTILIZERS"

"LIME ACID SOILS"

"GROW ACID TOLERANT CROPS"

SOIL ORGANIC MATTER AND FERTILITY LOSS

Organic matter was referred to earlier as the "seat of soil fertility." Recent alarm has been expressed by many researchers at the rate of loss of organic matter from Prairie soils. The extent of organic matter loss is shown in the figure below:



Soil organic matter losses from the A horizons of soils in the various soil zones of the Canadian Prairies. (From McGill et al, 1981)(8)

"ORGANIC MATTER LOSS"

MAIN CAUSES

- summerfallow
- intensive tillage
- reduced additions or removals of residues

ADVERSE EFFECTS

- loss of nitrogen
- lower nutrient holding power
- lower ability to resist pH change
- weaker aggregate stability
- loss of water holding capacity
- surface crusting
- erosion

CONSERVATION SUGGESTIONS

- grass-legumes in the rotation
- continuous cropping (reduce or eliminate summerfallow)
- fertilizer where required
- minimum tillage
- residue incorporation

SOIL MOISTURE CONSERVATION

The climate on the Prairies varies from semi-arid to sub-humid. The highest moisture deficits occur in semi-arid regions in the BROWN and DARK BROWN soil zones. The main method used in the past to conserve soil moisture following cropping has been summerfallow, but this practice has recently fallen into disrepute because of its affect on erosion, organic matter loss and the spread of salinity. Consequently, alternative measures are required to deal with the soil moisture storage and increase water use efficiency on the Prairies.

1. SNOW MANAGEMENT - to capture and store more of the moisture that arrives as snow

"SNOW WINDROWING"

"SWATHING AT ALTERNATE HEIGHTS"

"SHELTERBELTS"

"GRASS BARRIERS"

2. RESIDUE MANAGEMENT - to maintain a cover on the surface to reduce evaporation

"STUBBLE MULCHING"

"REDUCED TILLAGE"

"HERBICIDES"

3. CROPPING PRACTICES - to encourage good crop growth and produce higher yields for every cm. of water used

"TIMELY OPERATIONS"

"FERTILIZER PLACEMENT"

"WEED CONTROL"

"SEEDING RATES"

CHEMICAL CONTAMINATION OF SOIL

At present there does not appear to be a serious problem of chemical contamination of Prairie soils.[7] However, the potential exists through the following practices for increasing problems:

(1) widespread disposal of high rates of sludges
(2) long term use of metal-containing pesticides
(3) use of contaminated fertilizers and liming materials
(4) increased gaseous emissions from smelters, natural gas processing plants and coal fired power plants.

The following table summarizes the information on the chemical contamination of Alberta soils.

Chemical contamination of soils in Alberta

Contaminant	Source	Problem	Rate of Development	Extent	Techniques	Amelioration Time
SO_2	gas plants, tar sands	acidification	years - decades	general	liming	must continue while source continues
S dust	S stockpiles	acidification	months - years	local (acute)	liming	
Oil spills	pipelines, battery sites	nutrient immobilization, interference with water movement, some salts, some toxicity to plants.	Immediate upon a spill	several hundred hectares per year	aeration, drainage where necessary, nutrient additions to remove oil	1-6 years depending on amount of oil, cleanup procedures and reclamation techniques.
Salt water spills	as above	salinity, loss of soil structure, toxicity to plants.	Immediate	as above	replacement of sodium by calcium ions and leaching	1-3 years if it can be cured. When left too long, or in difficult to drain areas, or if initial leaching was done without calcium, the problem may never be totally eliminated.
Metals	soil parent material	toxicity to plants, animals and man.	Immediate	rare in Alberta		
	fertilizers	as above	decades - centuries	not known, but considered rare	Specific to element, best is to cease use before problem arises	Varies with element, sometimes not possible.
	sludges	as above	Can occur quickly if it does occur, but with proper sludge disposal it should not develop. No obvious problems yet in Alberta.		as above	as above
Pesticides	Herbicides, insecticides, fungicides nematocides, etc. used in crop production	Carry over to reduce succeeding crop growth, transfer to consumer of the plant, binding to soil with possible subsequent release in a large toxic pulse, disturbance of the balance of biological processes in soil, reduced biological control.	Immediate in case of spillage; possibly decades with normal use - if a problem does develop.	Not known. It has been generally concluded that there is no obvious problem yet in Alberta.	In case of spillage - adsorption of the material. In general ameliorative techniques have not been examined extensively.	

(From McGill, 1982)[7]

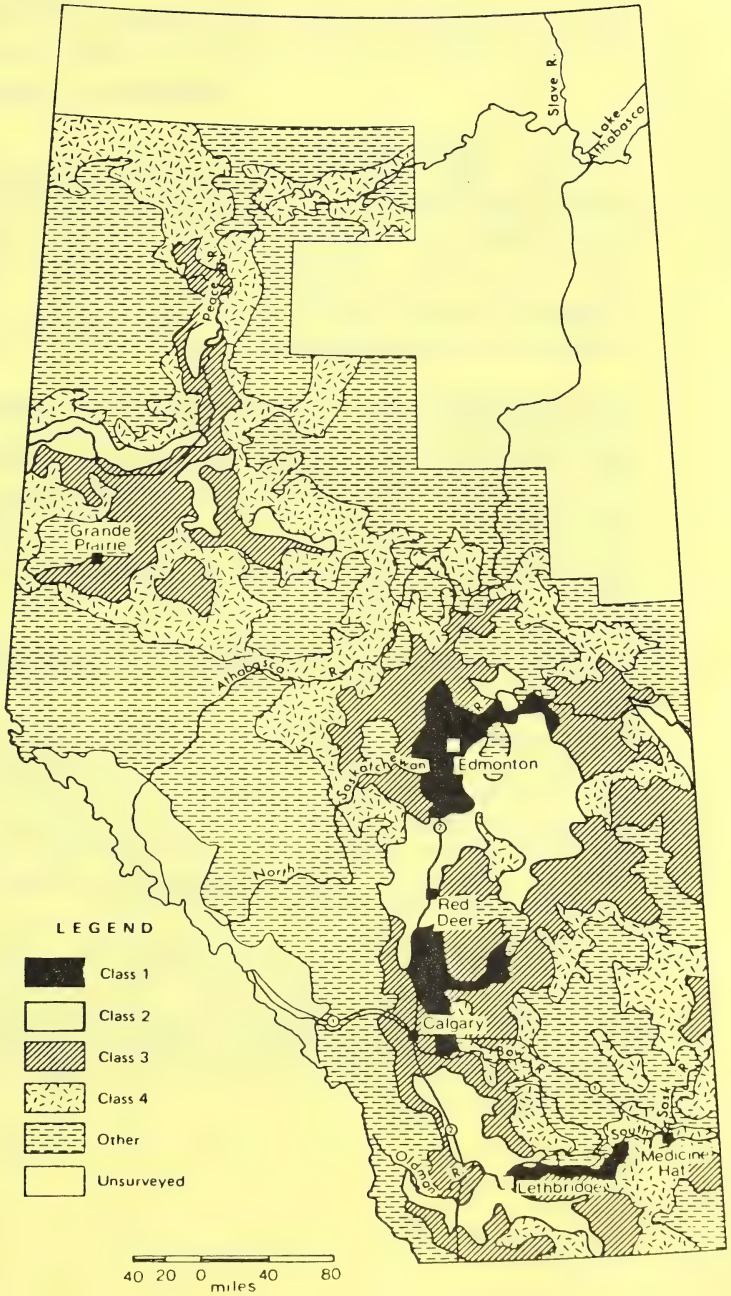
COMPETING USES FOR SOIL

Soil has been referred to as a dwindling resource in Canada. Throughout the country, agricultural land is being lost to non-agricultural uses. The main causes for increased competition for land are increases in population and increases in economic activity. The principal non-agricultural needs associated with these causes are urbanization, energy production, transportation, and recreation. The map below shows that most cities in Alberta are located on the best agricultural land in their region.(12)

AGRICULTURAL CAPABILITY

OF SOILS

IN ALBERTA



Concerns about the dwindling agricultural land base are, however, being expressed by farmers, scientists, and extension workers. Written articles on the non-renewability of soil have been increasing dramatically in numbers in the last few years. This speaks well for a heightened awareness and interest in the conservation of our most valuable non-human resource.

CONSERVATION PROGRAMS

The Department of Agriculture has been aware of the need of the adoption of proper soil conservation practices which will prevent the loss of valuable top soil through wind, water, or any other cause. It has been and still is the responsibility of the provincial government to prevent soil losses through negligence and misuse. The Department has established a number of ways to carry out these responsibilities, through education, demonstration, and legislation.

(a) Education - An education program of proper land use and conservation has been continuously directed at farmers and land users through district agriculturists, and municipal or county service boards. This has been done using publications, bulletins, press releases, short courses, farmers' meetings, radio, and recently television. Information provided is based on research and practical experience from within as well as outside the province. This has been one of our major efforts in the past and will continue to be in the future.

(b) Demonstration - The Department through assistance to farmers conduct demonstrations involving wind and water erosion control, gully filling and seeding of alkali or saline soil areas. Annually some 60,000 pounds of forage seed are supplied through one project alone for such work. The farmer pays for one-half the cost of forage seed and fertilizer. In addition, grants are provided through the Agricultural Service Board program to local municipalities for demonstrations and assistance for tree planting, gully filling, land reclamation from salts, wind and water erosion. Recently, those funds have been increased by federal government participation through the ARDA program.

(c) Legislation - There are a number of acts which directly or indirectly relate to soils and conservation. We will deal with two or three and make only mention of the others; these others include the Special Areas Act, Tax Recovery Act, Public Lands Act and the Land Utilization Act. Now to discuss in more detail two acts of more or less direct concern to soil conservation.

(i) The Soil Drifting Act, 1934 - Despite extensive soil losses in the chinook belt of Alberta prior to and during 1920, and the need for developing methods to cope with the hazard, it was not until 1934 that a substantial degree of wind erosion control had been developed. An officially appointed committee recommended to the Minister of Agriculture that legislation be enacted that would permit penalizing farmers who permitted their soil to drift. The act was passed but not until the penalty clause was substantially reduced. No prosecutions under the Act took place, however, a few cases were brought into court but a penalty was never imposed. This was the first act of this kind enacted in Canada. Saskatchewan passed somewhat similar legislation later. This act was repealed when the Soil Conservation Act came into effect in 1962.

(ii) The Soil Conservation Act, 1962 - This legislation was passed by the Legislature in April of 1962 to establish the principle that the Province of Alberta is concerned with the productivity of soil and that it intends to prevent the loss of soil through mis-management and misuse.

The following is a brief outline of the provisions of the Act and the steps which must be taken in order to carry out its administration:

1. Every Council shall appoint such soil conservation officers as are required to properly administer the Act. The appointee may be the Agricultural Fieldman of the Agricultural Service Board. A motion in the minutes of the regular council meeting is required for this appointment.

2. The Act applies the same principles of ownership responsibilities as does the Noxious Weeds Act and Agricultural Pests Act in that every person who owns, occupies or controls land shall take active measures to prevent soil deterioration by wind, water or any other cause.

3. This Act is to be used to conserve soil prior to the necessity of applying more stringent regulations as contained in the Agricultural Service Board Act. When habitual offenders continue to disregard the requirements of the Soil Conservation Act, then action under the Service Board Act, Sections 12 to 15 regarding supervision or reclamation may be necessary. The Soil Conservation Act imposes responsibility on the individual land owner, the Agricultural Service Board Act regarding reclamation - puts the responsibility on the counties.

4. As in any legislation, persons may appeal a notice issued by the Soil Conservation Officer before the expiration date as contained in the notice.

5. The Soil Conservation Officer or a person duly authorized by him may enter upon lands and perform the required work when such direction in a notice has not been complied with following expiration of the notice. Expenditures incurred for such work are chargeable to the Land similar to expenditures incurred under the Noxious Weeds Act.

6. A council may pass by-laws and provide for any of the following:

(a) A system of permits controlling the removal of topsoil from land.
(b) A system of permits controlling the burning of stubble on land.
(c) The prohibiting of the removal of any topsoil or burning of any stubble within municipal boundaries.

RECENT DEVELOPMENTS

1. Alberta (1983)

The concern for soil conservation has prompted the government to hold public hearings about the maintenance and expansion of the agricultural land base. A list of publications on hearing topics is included below to indicate the breadth of public concern over the soil conservation issues of today.

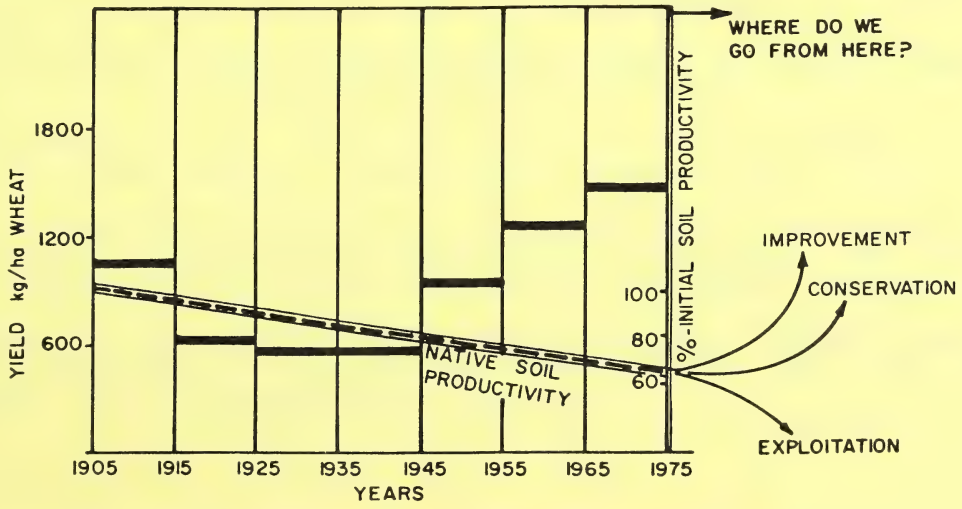
Description of Alberta's agricultural land base
Urbanization of agricultural land
Rural subdivision in central Alberta
The impacts of linear developments, resource extraction and industry on the agricultural land base
Recreation on agricultural land
The relationship between fish and wildlife resources and agriculture
Soil fertility and productivity
Dryland salinity
Factors affecting summerfallow
Agriculture and the environment
Irrigation agriculture
Selected issues concerning economics of agriculture
Effects of land use planning/practices on agricultural land
The options for protecting agricultural land
Legislation affecting agricultural land

2. Federal (1982)

The Federal concern over soil conservation of the Canadian Prairies has recently been manifested in the creation of a new branch in the Prairie Farm Rehabilitation (PFRA) -- The Soil and Water Conservation Branch. This new body has recently set out the program elements required for an effective and long range soil conservation progran in the Prairies.(9)

WHO IS RESPONSIBLE FOR SOIL CONSERVATION?

As people become more urban oriented, they are further removed from the soil and become less concerned about conservation. A generation of Canadians has grown up accustomed to cheap and abundant food. More and more food has been produced by fewer and fewer farmers with larger and larger equipment. What has been the cost? The answer is simple -- misplaced priorities and soil degradation. Since the breaking of prairie sod, the native soil productivity has continued to decline as illustrated below. This serious decline in productivity has not been reflected in yields due to the adoption by agriculture of improved technology such as fertilizers, herbicides, and improved crop varieties. However, how long can we continue to prop up this degrading situation?



(From Rennie and Ellis, 1978)[10]

The figure on the previous page asks the question -- Where do we go from here? Consider the following suggestions:

1. Change public attitudes via education, public hearings, media exposure, etc.;
2. Continue and expand support for soil conservation research;
3. Question old soil management practices;
4. Promote new and improved soil management practices;
5. Adopt conservation measures.

WHO IS RESPONSIBLE FOR SOIL CONSERVATION?

W E A R E ! !

REFERENCES

1. Alberta Agriculture. 1979. Dryland Saline Seep Control. Agdex 518-5. 7p.

2. Brown, L.R. 1981. Building a Sustainable Society. G.J. McLeod Ltd. Publ. Toronto. 433pp.

3. Reevey, E.S. et al. 1979. Mayan Urbanism: Impact on a Tropical Karst Environment. Science. October, 1979.

4. DeJong, E., H. Villar and J.R. Bettany, 1982. Preliminary Investigations in the Use of ^{137}Cs to Estimate Erosion in Saskatchewan. Can. J. Soil Sci. 62:673-683.

5. Holm, H.M. 1982. SAVE the SOIL - A Study in Soil Conservation and Erosion Control. Plant Industry Branch, Saskatchewan Agriculture.

6. Holm, H.M. and J.L. Henry. 1982. Understanding Salt Affected Soils. Plant Industry Branch, Saskatchewan Agriculture.

7. McGill, W.B. 1982. Soil Fertility and Land Productivity in Alberta. ECA82-17/1B16. Edmonton. Envir. Coun. of Alberta. 123pp.

8. McGill, W.B., C.A. Campbell, J.F. Dormaar, E.A. Paul and D.W. Anderson. 1981. Soil Organic Matter Losses. In Agricultural Land - Our Disappearing Heritage. Proc. 18th Annual Alberta Soil Science Workshop. Edmonton. pp 72-133.

9. PFRA, Soil and Water Conservation Branch. 1982. Land Degradation and Soil Conservation Issues on the Canadian Prairies -- An Overview. Mimeo Rept. 128pp.

10. Rennie, D.A. and J.G. Ellis. 1978. The Shape of Saskatchewan. Sask. Inst. of Pedology. Publ. M41. Univ. of Sask., Saskatoon.

11. Rostad, H.P.W., J.J. Kiss and A.J. Anderson. 1983. Surface pH of Saskatchewan Soils. Map. Sask. Inst. of Pedology. Publ. M67.

12. Thompson, P.S. 1981. Urbanization of Agricultural Land: Summary. ECA81-17/1B11. Edmonton. Enviro. Coun. of Alberta. 10pp.

13. Vander Pluym, H.S.A. 1978. Extent, Causes and Control of Dryland Saline Seepage in the Northern Great Plains Region of North America. Proc. Subcomm. on Salt-Affected Soils, 11th Intern. Soil Sci. Soc. Congr., Edmonton.

14. Walker, R.D. and R.A. Pope. 1980. Estimating Your Soil Erosion Losses with the Universal Soil Loss Equation (USLE). Coop. Ext. Serv. Coll. of Agric., Univ. of Illinois, Urbana-Champaign.

COMMENTARY OF

SOIL CONSERVATION SLIDES

PART 1- SOIL EROSION

Slide #1

Soil drifting or wind erosion is the movement of soil by the action of wind. This is a sorting and grading out of soil particles and their movement along the surface of the field as well as into the air. Tests have shown that the material blown away is at least 10 times higher in organic matter; has 9 times as much nitrogen and 19 times as much phosphorus as the soil that is left behind after soil drifting. Hence, it is very important that the loss of top soil by soil drifting be stopped. Soil drifting is a constant threat to much of Southern Alberta and is also a threat to Central and Northern Alberta. The chinook belt of Southern Alberta removes the snow cover during the winter months and exposes soil which has been broken down by the action of weather.

Slide #2

The sand dunes left at the edge of the fields and in ditches along roadsides or irrigation canals is a small part of the serious erosion that is created on the adjacent field. The silt and clay fraction of the soil has been blown far away and only the sand is left. It is important to hold the soil on the field.

Slide #3

Stubble burning is a practice that is not recommended in any part of Alberta since this is a destruction of much needed organic matter of fibre. In some municipalities, a permit is required before stubble may be burned and only under specific conditions controlling the fire. The burning of stubble is a wasteful practice and may only be justified when crops cannot be planted on land when fields are too wet for equipment. There is sufficient knowledge and equipment to take care of all stubble conditions and thus, there is not any need for such a practice.

Slide #4

Water erosion is a threat to all of Alberta and usually starts in this form called rill erosion. This one was caused by a $2\frac{1}{2}$" rainfall one afternoon in 1962 on a relatively gradual slope. Notice the cutting action higher up the hill and the silting at the bottom of the slope. This is the stage where remedial measures should be taken since this is an indication of a poor condition of the field. It is a sign of more erosion to come.

Slide #5

This is a gully which was eroded one spring runoff and is now weeded in. It cuts the field into two, is a hazard to the tractor operator and also is a weed menace. This erosion wasn't stopped soon enough.

Slide #6

This is gross negligence and very serious erosion. The gully here is 25' deep and will cost thousands of dollars to fill or prevent further erosion. It is therefore imperative that soil erosion be stopped in its early stages.

PART II - CONTROL MEASURES

Slide #7

To prevent soil drifting in much of Southern Alberta, a practice of strip cropping and trash cover farming has been adopted. The width of strips is dependent on soil texture, the lighter the soil texture the narrower the strips must be. It is important that trash cover farming be practiced on the worked strips as strip cropping alone is not sufficient to prevent soil erosion.

Slide #8

This shows cover farming which is the maintenance of straw and stubble on the surface of the field in order to hold down the surface soil, reduce the surface wind velocity and also make the soil more acceptable to rainfall. Trash cover farming is not only a practice recommended in the areas of wind erosion but also in areas where water erosion may be a threat.

Slide #9

This also shows a soil conservation practice in the use of fertilizer and crop rotations. These are experimental plots at Breton showing the use the fertilizer on red clover stand in the foreground and cereals and other grasses in the background. The plot on the left is the check plot or not fertilized, the plot on the right received nitrogen, phosphorus, potash, sulphur and barnyard manure. The building up of the organic matter and improving the physical condition of soils through the use of fertilizer and subsequent higher yields is an important soil conservation practice.

Slide #10

This shows a filled gully and the field being worked under rather normal conditions. It is important that such grassed waterways are sufficiently wide enough to carry the full volume of water. A rather detailed survey is best of such areas to include not only the required engineering features but also the anticipated run-off during spring breakup and during summer rainstorms.

Slide #11

The use of field shelterbelts to reduce wind erosion and catch and hold drifting snow in the winter is a recommended practice throughout all of Alberta. Here is a 10 - 20' caragana hedge back from the roadway which will catch and hold drifting snow and reduce wind velocities at the crown surface. Shelterbelts are effective for up to 20 times their height down from the field.

Slide #12

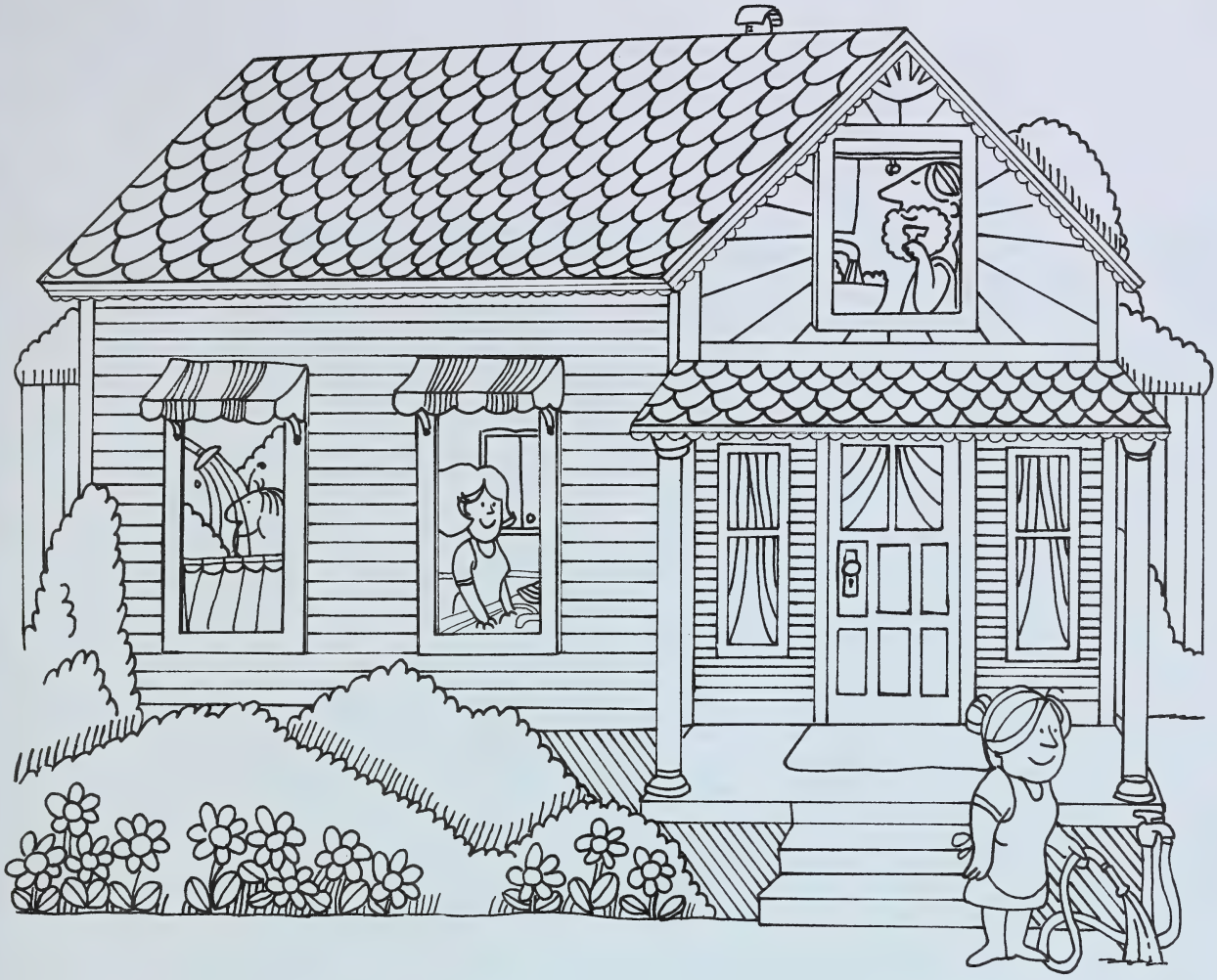
The control measures so far have been all long term practices. There are, however, some emergency or short term practices. One is the ridging and listering of fields for the control of soil drifting when it becomes a hazard. This cultivation was done in early April as the field had shown signs of erosion and the farmer took heed of these signs.

Slide #11

The use of field shelterbelts to reduce wind erosion and catch and hold drifting snow in the winter is a recommended practice throughout all of Alberta. Here is a 10 - 20' caragana hedge back from the roadway which will catch and hold drifting snow and reduce wind velocities at the crown surface. Shelterbelts are effective for up to 20 times their height down from the field.

Slide #12

The control measures so far have been all long term practices. There are, however, some emergency or short term practices. One is the ridging and listering of fields for the control of soil drifting when it becomes a hazard. This cultivation was done in early April as the field had shown signs of erosion and the farmer took heed of these signs.



WATER IS LIFE...

don't waste it

WATER CONSERVATION TODAY ~ AND TOMORROW

WATER CONSERVATION

IN ALBERTA

Prepared for:

4-H Conservation Camp
1980

By:

Jurgen Erxleben
Geographer, Water Use Section
Planning Services Branch
Alberta Environment

4-H CONSERVATION CAMP

WATER CONSERVATION - COURSE OUTLINE

APPROACH

The general approach of the course is a discussion of the elements of water supply and demand, and the problems of adjusting each to meet the changing needs. Regional patterns and their relationships will be discussed, also the interrelationship with other resources.

Use of maps, slides, films, field trips and other material will support discussions.

Most periods will be in the form of lectures and discussions. Students are encouraged to ask questions and take notes.

Fascinating facts about water will be covered, with concentration on how water is being used in Alberta.

AREAS COVERED

- water: nature's most versatile substance
- a perspective survey of water: where and in what form
- discussion of the hydrologic cycle (evaporation, transpiration precipitation)
- runoff relationships (too little or too much) streamflow, distribution, yield and regime patterns, quality, erosion, flooding
- water use facts and figures (consumptive and non-consumptive)
- water quality: pollution and ways to cleaning up
- water resource development, management, conservation.

NOTES

Notes prepared and lectures given by

Jurgen P. Erxleben
Water Use and Demand Analyst
Water Use Section, Planning Services Branch
Planning Division
Alberta Environment
9th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta
T5K 2J6

WATER CONSERVATION

Introduction

Water is all around us - as a liquid and as a vapour. We exist because of water; are ourselves part water, and cannot live without it. Yet we know little about water, where it comes from, where it goes to, how it is used, or even how much there is. We take water for granted and seldom think of it as a resource because it is such a common element and it is cheap.

Water is essential for human consumption and sanitation, and is used for many other purposes. Like any other commodity, the more water is used, the more it must be maintained, protected from abuse, and controlled so that an adequate supply is always assured.

The concern over water is reflected in its uneven distribution. The driving force behind this is the hydrologic cycle consisting of processes of evaporation, transpiration and precipitation.

It is a known fact that water covers 3/4 of the earth's surface; however, it cannot always be found in a useful form. Of all the water on the earth, 97.2% is in the oceans, unfit to drink, too salty for other uses as well. Another 2% lies frozen and useless in glaciers and icecaps. The small fraction that is left is not always found where it is needed because it is neither evenly distributed nor is it properly used. Man is faced with the problem of getting the best use out of less than 1% of the earth's water that is directly available for his use. Water conservation methods may provide some solutions.

We should not view our patterns of water resources and uses as a series of isolated demands. Instead, we should view the patterns and uses as continually interacting and conflicting with one another and other resources. Water is inevitably related to other elements of the whole physical environment; uncoordinated management programs can lead to inappropriate uses of available land and water resources.

Alberta's Water Resources

Water is one of Alberta's most important natural assets. It is a primary, vital natural resource and an important catalyst for balanced economic development.

Alberta is quite fortunate because water is found in relative abundance in many areas of the Province, although climatic differences result in considerable variation in supply from one region to another. Water originating in Alberta eventually reaches three different shores of the continent: the Arctic Ocean, Hudson Bay, and the Gulf of Mexico. Approximately 64% of the land area of Alberta lies within the Mackenzie

River System, which discharges to the Arctic Ocean. The river basins that form the Mackenzie System in Alberta (the Athabasca, Peace, Slave, and Hay Rivers) account for 86.5% of mean annual river discharges leaving the Province. The Churchill and Saskatchewan-Nelson River System (the Beaver, North Saskatchewan, Battle, Red Deer, Bow, Oldman, and South Saskatchewan Rivers), which discharge to Hudson Bay, cover 35% of the Province's land area but contribute only 13% of mean annual river discharges. The Milk River Basin, part of the Missouri/Mississippi River System, which discharges to the Gulf of Mexico, represents approximately 1% of the Province's land area, but yields considerably less than 0.5% of annual discharges.

Based on mean annual values, the streamflow originating within Alberta is 67.7 billion cubic metres (54.9 million acre-feet) per year. An additional 67.3 billion cubic metres (54.6 million acre feet) per year flow into Alberta from British Columbia, Saskatchewan and the United States. Less than 10% of water originating in Alberta is withdrawn annually for the use of Albertans.

Groundwater is another source of water supply, but it is highly variable in both quantity and quality depending on location.

Alberta has a geographic imbalance between the area of greatest water supply and the area of greatest water demand. The southern half of the Province has approximately 15% of the total water supply but 80% of the total water demand. Water management problems in Southern Alberta are generally concerned with water supply, while flooding and erosion are major concerns in Northern Alberta.

Seasonal variations in flows also present water management problems. The river discharges vary from early summer peaks to very low winter flows. The high flows occur for a relatively short time but move enormous volumes of water. Without some form of flow regulation, these large volumes of water pass through Alberta mostly unused and in some cases cause flood and erosion damage.

The seasonal variations in flows are influenced mainly by the fact that the major rivers have their headwaters in the Rocky Mountains where the Eastern Slopes have relatively steep gradients and there is high precipitation (80-90% of Alberta's water originates in the mountains and foothills) and low retention of water in the soils. These factors combined with the particular climatic conditions of the region contribute to the wide variation in seasonal flows. The greatest seasonal variation as well as variations in the total discharge from year to year tend to occur in the southern rivers. Therefore it is essential that the Province's water resources are managed carefully and wisely for the benefit of all Albertans.

The Water We Use

Water, whether beneath the ground or above the surface, is of tremendous importance to man. This resource constitutes a valuable source of supply for individuals, communities, industries, agriculture,

and transportation. Water is used extensively for a wide variety of purposes which include domestic cooking and washing, waste disposal and dilution, industrial manufacturing and cooling, farm irrigation, livestock, recreation and aesthetic purposes, and many other uses.

Modern living has increased man's use of water many fold. The per capita consumption of water in Alberta is estimated to be about 270-675 litres (L) per day (60-150 gallons per day, gpd). A high standard of living without the provision of a plentiful water supply of good quality is out of the question.

There are basically three main categories of water demands: 1) domestic, 2) industrial, 3) agricultural. Each of these has its own water use characteristics, and after the water is used it is returned in a modified form.

Under the Province's Water Resources Act water uses are ranked according to priority for use as follows: domestic, municipal, industrial, irrigation, water power, other purposes. The following estimates, based on 1975 data from the Second National Water Assessment in the United States, provide some insight into water use (withdrawals and consumption). Consumption of water in some respects is more critical than the total quantity withdrawn for use because consumed water is not available for downstream uses or for groundwater recharge. Consumptive use is not equally proportionate to withdrawals among the functional use categories. Agriculture was responsible for 83% of the total water consumed in 1975.

TOTAL WITHDRAWALS AND CONSUMPTION,
BY FUNCTIONAL USE, 1975
(millions litres per day)

FUNCTIONAL USE	WITHDRAWALS	CONSUMPTION
Domestic	104,652	28,206
Industrial	687,254	48,524
Agricultural	722,948	397,364

1) Domestic Water Use

Good hard facts on per capita water use or for other domestic purposes are difficult to come by, besides, there are numerous factors that influence water uses. The Plumbing Manufacturing Institute found that a typical family of four uses an average of 1148 L (255 gal) of water each day, or about 288 L (64 gal) per person. The use of water in an average home consists of the following:

Car washing	1%
Lawn and garden watering	3%
House cleaning and scrubbing	3%
Laundry	4%
Drinking	5%
Cooking and dishwashing	6%
Personal hygiene (bathing, showering)	37%
Toilet	41%

Some other facts on water use in the home are the following:

Adult bath	45-68 L	(10-15 gal)
Shower	36-54 L	(8-12 gal)
Automatic clothes washing	68-180 L	(15-40 gal)
Toilet flushing (per flush)	23-32 L	(5-7 gal)

Consider the quantity of water lost by a dripping faucet, that at a rate of one drop per second can amount to 18 L (4 gal) a day, and to 6570 L (1460 gal) a year. Much water may be wasted in the average home. Water wastage can account for about half the volume normally used in municipalities.

2) Industrial Water Use

Water is also a key raw material in almost all industrial processes. Industries use water as an input to the production of goods by cooking, cooling, washing, generating steam, ingredients for final goods, drinking, and sanitary purposes. Water may also be one of the number of factors that influence the location of industries. The availability of water is becoming more important as a result of environmental regulations, competing demands for water resources, and the decreasing number of suitable industrial sites.

Certain types of industries, particularly manufacturing firms, are concentrated in major urban centres. All the mines and most of the thermal power generating stations are located in unincorporated rural areas.

Results from the 1976 Alberta Industrial Water Use Survey indicate that industries withdrew a total of 1,586,203 million L (349,384 MIG); more than 94% of this volume is accounted for by industries with an intake of 45.4 ML (10 MIG) or more per year. Eightyone percent of the water intake is attributed to thermal power generation plants, which have intake volumes over 454 ML (100 MIG) annually. Of the total water intake only 4% was consumed.

The four largest manufacturing water using industries included the chemical products, wood, paper and allied products, and non-metallic mineral products industries. Together they accounted for nearly 80% of water use of all manufacturing industries. The chemical products industry was the largest manufacturing water using industry accounting for 36% of this groups total water use.

Nearly 96% of the water used by industries was obtained through privately owned systems located on surface water sources. The remaining 4% was derived from groundwater sources and from public utility systems. Some industrial water use facts are the following:

PRODUCT	UNIT	AVERAGE USE (gal)
Meat (packing)	1 ton	6,000
Steel (depending on type)	1 ton	18,000-65,000
Paper (depending on type)	1 ton	35,000-85,000
Petroleum, oil refining	1 million barrels	770,000
Petroleum, aviation gas	1 million barrels	1,050,000
Steam-generated power	1 million kWh	110,000
Cane sugar (refining)	1 ton	15,000
Beer and ale	1 barrel	450

3) Agricultural Water Use

Water is also one of the basic input factors of agricultural production. This sector is by far the largest user of water both for withdrawals and consumption. Water is utilized for three main purposes: irrigation, stockwatering, and rural residential uses, of which irrigation is usually the largest use. In order to appreciate this fact consider the volumes of water used in producing the following crops in southern Alberta:

CROP	AVERAGE YIELD PER ACRE	AVERAGE USE OF WATER
Alfalfa	5.21 tons (dry)	25.5 inches
Grass, pasture	2.20 tons (dry)	23.6 inches
Sugar beets	20.35 tons	21.5 inches
Potatoes	397.7 bushels	19.9 inches
Soft wheat	64.3 bushels	19.4 inches
Hard wheat	53.0 bushels	18.2 inches
Oats	85.0 bushels	16.1 inches
Barley	61.1 bushels	16.1 inches
Flax	27.8 bushels	15.2 inches
Canning corn	5.1 tons (ears)	15.2 inches
Tomatoes	6.4 tons (ripe)	14.4 inches
Canning peas	2.8 tons (green)	13.4 inches

In 1976 a total of 2,050 million cubic metres (m^3) or 1,662,250 acre feet (ac ft) were diverted for irrigation in the irrigation districts of Alberta. Of this 26% or 529 million m^3 (428,680 ac ft) were returned. Thus a total of 1,521 million m^3 (1,233,570 ac ft)

were consumed. A total of 314,560 hectares (786,400 acres) were irrigated and consumptive use averaged to 1.937 m^3 per hectare (1.57 acre feet per acre).

Water - A Controllable Resource

Water is a manageable resource, and man has learned how to control it for his use in spite of huge demands that our society makes on this dynamic resource. In order to use the water flowing in a stream storage reservoirs, dams, distribution systems and transportation networks must be planned, designed and built. Dams generally are built to facilitate the use of water for irrigation, power generation, flood control, recreation, industries and municipalities. Occasionally seasonal water shortages and/or surpluses occur as a result of uneven distribution of water or sometimes resulting from man's activity.

In order to manage the water resources effectively a tremendous amount of background information is collected annually. This information, which is not easy to collect, is used to answer questions such as:

How much fresh water is accessible and where is it?
What is its quality?
What must be done to improve that quality?
How should the water be shared in water-short areas?
How should the water be controlled in flood prone areas?
Etc.

Information is also required on the many and varied uses of water for municipal, industrial, and agricultural purposes, as well as its use to support fish and wildlife, navigation, power generation, and recreational activities.

A problem with the water resources on the prairies is the poor distribution of surface water supplies. Most of the water flowing in the prairie rivers during spring and summer was stored in snow during the preceding winter. This runoff averages to about 17% of the annual precipitation that falls on the prairies. Forecasting the flow that can be expected is another important function of managing the water resource. Furthermore, by practicing forecasting, we are applying means of testing our understanding of the hydrologic system of an area.

Water Control - Key to Prairie's Future

The prairie provinces are subject to severe and unpredictable drought. A few years of tremendous development may be followed by seasons when fields and ponds dry up, withering the crops, parching livestock and leaving people without adequate good water for domestic or industrial use.

Due to the dynamic nature of the water resource in terms of location and use, man can only control it partially. In regions which are usually low in rainfall but which are traversed by streams, water for irrigation, power or other purposes may be provided through storage of runoff. The conservation of water in this manner becomes an important factor in any scheme for economic improvement.

The streamflow originating in the East Slopes area of Alberta is used for many purposes. The overall management of both the land and water resources of the East Slopes area has an impact in the three prairie provinces and in the Northwest Territories. Judicious management of the forest resource in these watershed areas is vital to the future well-being of irrigation agriculture.

Because of increasing pressures from urbanization, industrialization, and agricultural production in the prairie provinces, there are definite needs to control the flow of rivers to procure downstream benefits for water users. Through the construction of dams, storage reservoirs and diversion channels, water may be diverted to areas of need.

Streamflow in prairie rivers is erratic, and the potential scarcity of water increases the need for water management principles one of which is water conservation. In general, Alberta has a good supply of good quality water, however it may not be available in the right quantity and quality at the right place, at the right time.

The recognition of the regional importance of streamflow in the prairie region is manifest in the Master Agreement on Apportionment by which Canada, Alberta, Saskatchewan and Manitoba agree to apportion the flow of interprovincial streams in the prairie provinces, and by which the Prairie Provinces Water Board has been established to administer the agreement. This agreement permits Alberta to consume 50% of the natural flow of a river before it enters Saskatchewan; Saskatchewan may consure 50% of the flow entering the province from Alberta and 50% of the additional flow arising within its boundaries; Manitoba receives the remainder.

Water and the Farm

Farms are vital to the production of our food, and furthermore are important to conserving soil and water resources. How the land is managed will have an influence on how moisture is used by a crop and how this contributes to conserving water resources. Land in pasture may take in 10 times as much moisture as bare land. Land may also be compacted by heavy grazing, so that it can not absorb much water to grow crops or replenish underground moisture reserves. To produce the greatest amount of food possible on his land, a farmer must make good use of the moisture that falls on it. On top of that he can often increase yields per acre by applying irrigation water from a stream or reservoir.

Crop production on the prairies may be limited in some years by a lack of sufficient moisture. Low lying areas have potential for growing crops. These areas are occupied by sloughs both large and small, some of which are permanent features on the landscape and some dry up during the summer bearing a hay crop. Draining sloughs and at the same time making as much use as practical of the excess water offers a substantial possibility for increasing crop production on the farm.

Sloughs may reduce the productive acreage of a farm and increase the cost of operation. Loss in production and an increase in expense affects many farmers. Economic loss is significant but there is a range in losses caused by a fluctuation in the area flooded from year to year. This means that an individual farmer may not have to contend with sloughs every spring. A drainage system, therefore, should be low in cost and have the capacity to drain the flooded area quickly to permit spring seeding or to eliminate drowning of the hay crops.

Decision to drain sloughs and the method to use depend on several factors. One is the possible effect that the drainage may have on the supply of groundwater. Sloughs can be divided into recharge and discharge types. The recharge slough contributes to groundwater recharge and is much more common than the discharge slough. Slough drainage, therefore, should allow for ponding of runoff water during the winter and early spring to provide opportunity for groundwater recharge before draining. Also, consider the soil characteristics of the flooded land, and the quality of the water in the slough if it is to be used for irrigation. Other factors to consider are size of the slough, depth of the water, topography, cost and expected returns, available labour, and possible involvement of the neighbour or neighbours.

Soils everywhere may also be subjected to erosion by water. Uncontrolled water is one of nature's most destructive forces. The rate at which a soil is eroded is governed by a number of factors including precipitation, size of drops, speed of fall, amount of rain in a given time, temperature, season, type of soil, topography, and type of plant cover. We can not change rainfall over great regions but we can do things to lessen the harmful effects of erosion by water on soil. Some of these things are: crop rotation, maintenance of a trash cover, grassed waterways, contour ploughing and strip farming.

Water Pollution

It is easy to take water for granted. We are prone to over-estimate its abundance, and to underestimate its importance, not only to our own survival but also as an essential support system for life in general.

Water, in its natural state is never pure, but there will be a variety of minerals and salts including such substances as silica, iron, manganese, sodium, potassium, bicarbonate, carbonate and others.

Water, in a polluted state, that is "water pollution" is the term commonly applied when the quality of a natural water resource is downgraded by household sewage, industrial wastes (phenols, oil, nutrients, phosphates, mercury, etc.), thermal discharges, and other wastes where further use of the water is adversely affected.

Water is an efficient and economical carrier of undesirable materials, but because of the apparent abundance of water in the Province, there has been a tendency to ignore or forget that there are limits to the amount of waste matter which any water course can absorb.

The most common factor in determining the health of any river is the amount of dissolved oxygen present. This is used as a measure of the pollution which has occurred in a stream.

Wastes released into a stream create biological activity. This activity exerts a demand for oxygen in the water, and when this is not present the wastes are not broken down.

Stream pollution may be reduced by removing many of the harmful substances from wastes before discharging them into receiving waters. This might be done in septic tanks, sewage lagoons or sewage treatment stages.

Water Conservation

Conservation generally may be defined as deliberate, planned, or thoughtful preserving, guarding, or protecting of a natural resource. Yet, for most of Alberta, simply preserving, guarding or protecting water is not a real need. The Province's water is a relatively plentiful, renewable resource. It is used for many things, including drinking, manufacturing, carrying away waste, recreation, and aesthetic enjoyment. All these uses are legitimate; the need is for a balance among them.

There are two other common definitions of conservation:

1) planned management of a resource itself,
2) wise utilization of a resource.

Both imply a focus on society's deriving value from a resource, now and in the future. These ideas are emerging in a new kind of water conservation ethic, one that emphasizes efficient use of existing supplies as well as reductions in demand. The ultimate goal of water conservation is to avert critical shortages through controlling, protecting and utilizing the water resources of Alberta to meet present and future water needs for all beneficial purposes and uses in all areas of the Province so far as is practicable. If better management and technology can reduce water use while producing the same services, the efficiency of water use can be increased.

The conservation of water in Alberta, on a large scale, comes under the umbrella of the Alberta Department of the Environment. The Government of Alberta has water conservation as one of its principles relating to water management. By this principle the Government of Alberta is promoting wise and efficient water use, and encourages:

- development of a social consciousness toward the creation of individual obligations to use water without waste,
- emphasis on greater water use efficiencies to reduce water losses and excessive use,
- water conserving technology in irrigation,
- water reuse where such is feasible.

This principle furthermore assures that the multi-purpose water needs of Albertans are met and that water-related problems are solved. Obviously not all problems related to water resources can be solved by water conservation, however it may help to solve some and may provide time to deal with others.

Water conservation is a tool which may be integrated into our plans for the wisest use of this limited resource. Ideally it should consist of proposed changes that will,

a) reduce demand for water;
b) improve efficiency in use and reduces losses and waste;
c) improve land management practices to conserve water.

Water Conservation Measures

Some hope in conserving water lies in proper land management practices. This will contribute to retention of soil moisture which in turn will contribute to an increase of crop production per unit area of land. The following precautions can be used to reduce erosion and to conserve water:

1) Using types and varieties of crops best suited to local conditions so that improved conditions of any sort will be reflected in higher yields.

2) Using cultivation methods suited to local conditions:

   a) in semi-arid regions, trash cover and rough surface to encourage moisture to filter into the soil instead of running off, and to discourage evaporation and erosion, which lessens the moisture holding capacity of soil and increases runoff.

   b) in low, wet areas, drainage for proper conditioning of soil so crops can make good use of water that is left.

c) contour ploughing and terracing on steep slopes to increase moisture retention and infiltration, and in turn reduce runoff and erosion.

3) Increasing the humus content of the soil through incorporating manure and straw in it, or using forage crops in rotation to improve ability to store moisture and benefit from greater activity of micro-organisms.

4) Fertilizing as required so crops can make better use of available moisture.

5) Planting field shelterbelts to encourage accumulation of snow and to lessen wind, thereby reducing losses from evaporation, transpiration and soil drifting.

6) Providing dams and dug-outs for irrigation of specialty crops adapted to the region which make good use of extra water. Construction of ponds, diversions, and waterways for other purposes such as power production, flood control, fish and wildlife enhancement, recreational, industrial, and municipal uses.

7) Planting windbreaks near dams and dug-outs to encourage snow to pile up around them, to conserve runoff for summer use and to reduce evaporation.

8) Spring flood irrigation on suitable land, to use the water that would otherwise run off.

9) Giving water priority to heavy soil with high fertility and ability to retain moisture.

10) Timing irrigation to meet water requirements of a crop.

11) Planting steep slopes to trees to check erosion, hold snow, lengthen the season of snowmelt and encourage moisture to filter into the soil.

12) Planting other erosion-susceptible land to grass and legumes to protect the soil, from crop use and amount of water entering the soil, for crop use and groundwater supply.

All of the preceding practices when they are applied as needed, will go a long way in providing the most effective use of water and help in conserving it.

We as individuals also can help to conserve water. The following are tips to help use water more wisely in the home:

1) Check faucets for leaks. A slow drip wastes 68-90 litres (15-20 gallons) per day.

2) Put a bit of food colouring in the toilet tank to see if it is leaking into the bowl. Leaky toilets are among the home's worst water wasters!

3) Don't use the toilet as a garbage disposal. One flush uses between 23-32 litres (5-7 gallons).

4) Don't shower too long or fill the tub too full (5 minutes for showering and about 13 cm (5 inches) in the tub are plenty).

5) Don't leave water running for tooth brushing, hand washing, vegetable cleaning or dish scraping. Use only what's needed, then turn it off.

6) Use dish and clothes washing machines with full loads only.

7) Don't let the faucet run for a cold drink. Keep a jug of cold water in the fridge.

8) Water the lawn and garden with good sense. Do it early or late, not in mid-day heat. See that the water goes where it should, not on sidewalk and driveways. Don't leave sprinklers on too long.

9) Never use the hose to clean off driveways and sidewalks, a broom is much better.

10) Wash the car from a bucket. Use the hose only to wet down before and rinse-off afterwards.

Why Conserve Water?

Water is a priceless asset and a precious natural resource. It must be effectively used, without actually interfering with the use itself. Traditionally, water conservation methods have been turned to only in times of drought crisis and severe shortages. In such situations emergency measures are usually imposed to reduce consumption. Water is there for everybody, if we don't use it wisely we will not have any good quality or quantity of water later. We all have a part to play in the conservation of water, since it is a matter of individual necessity for each of us.

Since water, as well as soil are civilizations two most basic resources, their conservation should be fitted into a general scheme of total environmental conservation. Plans for their conservation should include adequate attention to proper land conservation in watershed areas. The use of soil conservation methods on agricultural lands can lead to better use of soil water. Other important factors to be considered are the importance of fisheries and wildlife resources, wilderness and wildlands, recreational and aesthetic values. Improving land use practices on forestland, rangeland and cultivated fields could

contribute to increasing infiltration, stabilizing runoff, and bringing greater yields in timber, forage, and crops.

We in Alberta should never run short of useful water provided that this resource is managed carefully. Water has been and will continue to be one of the most important resources affecting the health and welfare not only of our Province but also our whole country.

PLATE 1. THE HYDROLOGIC CYCLE

Introduction

Hydrology is the science concerned with the occurrence and distribution of water on and under the earth. Meteorology is the science dealing with the atmosphere and the movement of water, both as vapour and as liquid, in the air. Both sciences are concerned with the hydrologic cycle—the circulation of water from oceans through the atmosphere back to the oceans or to the land and thence to the oceans by overland and subterranean routes [1]. This cycle of water movement is shown pictorially on Plate 1.

The ultimate driving force for the hydrologic cycle is the sun. Atmospheric circulation, initiated by the energy from the sun and influenced by the rotation of the earth, transports atmospheric moisture to areas where conditions are favourable for condensation into particles large enough to fall to the earth's surface because of gravitational forces. These forces cause liquid water to flow over and under the land surface to places where solar energy causes evaporation; the cycle then repeats itself. Although the basic hydrological cycle is simple in concept, it is extremely complex in detail because there are so many different paths a water molecule can follow.

A quick glance at the accompanying diagram shows that water is constantly on the move. Evaporation takes place from a multitude of surfaces ranging from a free water surface on the ocean to the moisture on a leaf. Precipitation falls in various forms—snow, rain, hail, etc.

Distribution of the World's Water Supply

	Volume (1000 km³)	Percent of total water
Water in land areas:		
Fresh-water lakes	125	0.009
Saline lakes and inland seas	104	.008
Rivers	1.25	.0001
Soil moisture and vadose water	67	.005
Ground water to depth of 4000 m	8350	.61
Icecaps and glaciers	29,200	2.15
Total in land area (rounded)	37,800	2.8
Atmosphere	13	.001
World ocean	1,320,000	97.1
Total, all items (rounded)	1,360,000	100
Annual evaporation:		
From world ocean	350	
From land areas	70	
Total	420	
Annual precipitation:		
On world ocean	320	
On land areas	100	
Total	420	
Annual runoff to oceans from rivers and icecaps	38	
Groundwater outflow to oceans	1.6	
Total	39.6	

Also, moisture is deposited on the surface of the earth by the formation of dew and frost. Water is stored for varying lengths of time in a number of forms including atmospheric moisture, water in swamps and lakes, soil moisture, groundwater, ice in glaciers, and snow on the ground. Water is transferred from one environment to another by surface runoff, infiltration from the surface, groundwater flow, and via atmospheric vapour carried by winds. The table, modified from a study by Nace [2], gives estimates of the world's water supply.

The Evaporation Process

Evaporation of water (emission of water vapour from surfaces) and evapotranspiration (transfer of water from the soil to the atmosphere by transport through plants and subsequent evaporation) are the processes by which the atmosphere is recharged after loss by precipitation. Some water is caught by plants, temporarily stored, and later evaporated directly to the atmosphere; this is known as interception loss.

Evaporation at a free water surface is governed primarily by climatic factors, such as humidity and temperature of the air, wind speed, solar radiation, cloud cover, and by the nature of the evaporating surface. The amount of water transferred to the atmosphere by evapotranspiration depends on factors such as soil and vegetation types, as well as climate. Thirty per cent of the earth's surface is covered by soil, vegetation, and surface rock, so that the speed at which water moves through plants forming the vegetative cover must also be considered. For a full account of factors affecting evapotranspiration rates, see reference 3.

The Precipitation Process

For precipitation to take place, a number of conditions must be met simultaneously. Assuming that there is sufficient water vapour, the air must be cooled below the dew point, and condensation nuclei, such as sea-salt crystals or dust particles, must be present. Air expands and cools when it is lifted to higher altitudes in extra-tropical cyclones or forced upwards along a front by daytime convection, orographic obstacles, or hurricanes. Under normal conditions, Canada is affected by all except hurricanes.

The nature of the Canadian climate ensures that all forms of precipitation are experienced. Rain (liquid water droplets with typical diameters of 1 millimetre) forms the largest portion of our precipitation. Snow is the next most prevalent form of precipitation, producing an estimated 50 per cent of the total annual precipitation in the north country, 25 per cent on the Prairies, and less than 10 per cent on both coasts and in southern Ontario. Hail (ranging in diameter from 5 to 50 millimetres), sleet (a snow and rain mixture), dew (condensation of water vapour on objects in the form of water drops), and hoarfrost (deposits of ice produced in a fashion similar to dew, but at a temperature below 0°C) contribute a small proportion of Canada's total precipitation.

The Surface Runoff Process

Water may follow many different paths on its way to the sea depending on how it reacts with the surface on which it falls. Some will fall on streams or lakes and run off directly to the ocean. Some "surface water" will collect in surface depressions, then overflow and move down slope in thin films and tiny streams, which eventually reach an established stream [3].

The Subsurface Runoff Process

Once past the vegetal cover, water encounters the soil surface and may become surface runoff or may infiltrate and become part of the subsurface runoff process, depending on the material at surface and the intensity of precipitation. Surface runoff occurs only if the precipitation intensity exceeds the infiltration rate of the soil plus the interception and evaporation losses.

Water that infiltrates the soil surface may do one of three things. It may "interflow" just under the surface and discharge directly into a stream without joining the main groundwater body; it may percolate down to the groundwater table and flow slowly through groundwater flow systems for periods varying from days to thousands of years before reaching a stream channel or an ocean; or it may join the unsaturated zone by forming soil moisture that eventually returns to the atmosphere via evaporation and evapotranspiration.

Summary

The most important aspect of the hydrological cycle is not the quantity of water residing in the world's water bodies and atmosphere at any particular instant but rather the rates at which water is transported from one part of the cycle to another. Water is constantly on the move; constantly reacting with its physical, chemical, and biological environment; constantly changing its state, i.e. liquid, vapour, solid; and constantly reshaping the face of the earth and allowing life as we know it.

Acknowledgments

The text was prepared by the Secretariat of the Canadian National Committee for the International Hydrological Decade.

Selected References

[1] Bruce, J.P. and Clark, R.H. 1966. Introduction to Hydrometeorology. Pergamon Press, Toronto.

[2] Nace, R.L. 1967. Are We Running Out of Water? U.S. Geol. Survey Circ. 536.

[3] Gray, D.M. (Editor) 1970. Handbook on the Principles of Hydrology. National Research Council of Canada, Ottawa.

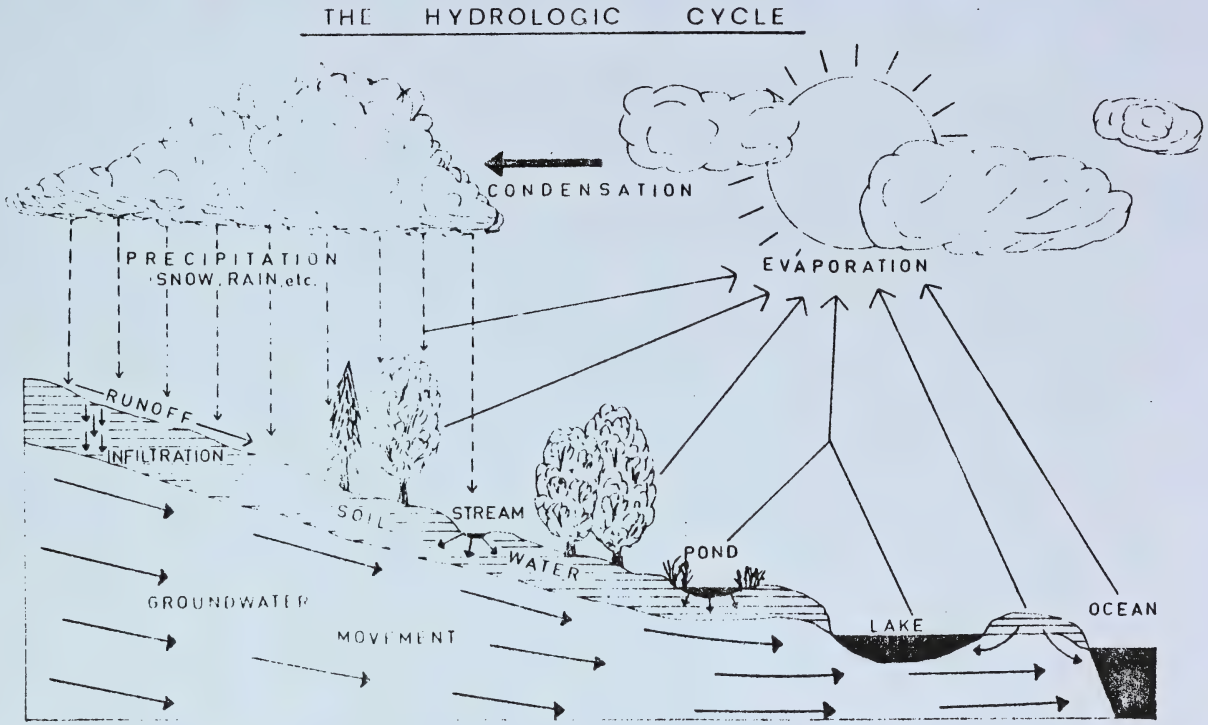
[4] Canada Water Year Book 1975. Department of the Environment or Information Canada, Ottawa.

[5] Brown, I.C. (Editor) 1967. Groundwater in Canada. Department of Energy, Mines and Resources, Ottawa.

[6] Linsley, R.K. Jr., Kohler, M.A., and Paulhus, J.L.H. 1958. Hydrology for Engineers. McGraw-Hill Book Company Incorporated, New York.

[7] International Glossary of Hydrology, 1974. First edition, Secretariat of the World Meteorological Organization, Geneva, Switzerland. WMO/OMM/BMO - No. 385.

[8] van der Leeden, F. 1975. Water Resources of the World. Water information Center, Inc., Port Washington, N.Y.



Groundwater is part of the hydrologic cycle, in which water is in a continuous motion, ceaselessly being evaporated from and precipitated onto the surface of the earth.

4H-CONSERVATION - WATER CONSERVATION

Some Things To Think About

1) Why is water important to life?

2) Where does water come from, where does it go, how is it used and how much water is there?

3) Why and how is water important in Alberta?

4) How is water important to you at home, in your community, and region?

5) What is meant by "interrelationship between land and water?"

6) What physical states can water be found in?

7) How much of the earth's surface is covered by water?

8) Why is water's ability to dissolve other materials important to all life?

9) Water containing many impurities conducts electricity better than pure water, true or false?

10) How did the oceans get salty?

11) a) What makes water hard?
b) How can it be softened?

12) The process of making water fit to drink requires removing impurities by filtration, precipitation or chemical neutralization. What are some of the best materials used for filtering water?

13) Where is the water found, in what proportions?

14) How much of the earth's total water supply is available to provide for most of our water needs?

15) Many people believe limestone caves are a major source of groundwater. Actually, pools or rivers in these cavernous formations represent only about (how much) percent of the total groundwater reserves of the earth?
a) 25% b) 17% c) 5% d) 1%

16) What is groundwater and how can we get it to use it?

17) What is the hydrologic cycle? What are the main stages of this cycle? What happens in the main stages?

18) What is weather?

19) What is climate?

20) What is climatology?

21) What is meteorology?

22) How much water do you use?

23) The household use of water never changes, true or false? Why?

24) List some water uses for the following:

a) private households - 5
b) towns and cities - 2
c) industry - 3
d) power development - 1
e) transportation - 2
f) agriculture - 2
g) fisheries - 1
h) recreation - 4
i) waste disposal - 2

Which one of the above is the largest user of water?

25) The average city dweller uses about (how much) gallons (litres) of water a day?

a) 25 gal. (113 L) b) 75 gal. (338 L)
c) 150 gal. (675 L) d) 200 gal. (900 L)

26) Is water controllable?

27) What can be done to overcome local water shortages?

28) What is the main problem with conserving resources?

29) How and why is the quantity of water measured?

30) What percentage of Canada's total area is covered by fresh water?

31) What factors influence the rate of flow in a river?

32) How are floods caused, that is what conditions are necessary for flooding to happen?

33) Why is it necessary to irrigate?

34) How can water be conserved on the farm, that is used in a better way? What are some methods and practices available that will help to conserve water?

35) How are water and forests interrelated? Why are forests so important in the Foothills? Why should we keep the forests and control their development?

36) What is water pollution?

37) What can you do to prevent water pollution?

38) How is water as a resource, different from other resources?

39) Who owns the province's water resources?

40) How can we achieve water conservation? Why should we conserve it?

41) What is water conservation to you?

42) a) What is integrated development?
b) What advantage is there to integrated development?

43) What factors have to be considered in the administration of water resources?

USEFUL REFERENCES

1) Canada Water Year Books, 1975, 1976 and 1977-1978.

2) A Golden Guide of Pond Life.

3) A Golden Guide of Weather.

4) Water by V.A. Morris.

5) Groundwater in Canada.

6) Growing irrigated crops on the Canadian Prairies.

7) Soil erosion by water.

8) Irrigation water its use and application.

9) Gully filling and watercourse improvement.

10) Slough drainage and cropping.

11) Water by J.G. Nelson and M.J. Chambers.

12) Water resources management principles for Alberta.

COMMENTARY ON WATER CONSERVATION SLIDES

1. Water is everywhere, it is a common, dynamic liquid: we see it as rain, snow and fog, in the oceans, lakes and rivers and what comes rushing out of the tap when we turn it on. Water covers nearly 75% of the earth's surface, and comprises nearly 70% of man's body by weight. The better we understand the water resource, the better we can use it.

2. Water comprises one of the more important natural resources because it is vital to all living organisms both plant and animal. A great variety of aquatic lifeforms from the microscopic amaeba to the large whale exists in water. Plants are also very dependent upon water. In many of them it is almost always the largest constituent.

3. Water has played an important role in history. Civilizations flourished because of a good supply, and perished because of a lack of water. Waterways were used by the early explorers of our country as they most often were the most economical and quickest routes. The use of water bodies as means of transportation is a popular method of shipping many goods. In Alberta barge trains are a common sight on the Mackenzie River system. The construction of the Welland Canal, part of the St. Lawrence Seaway system provided a route connecting Lake Ontario and Lake Erie. Ships from many nations travel through the canal annually.

4. Water has recreational, aesthetic, cultural, and inspirational values which contribute to the quality of human life. Water recreation plays an important role in society around the world. Whether it be in, on or under water, almost everyone enjoys some sort of water recreation. To mention a few there are activities such as water skiing, swimming, scuba diving, fishing, water polo, sailing, boating and synchronized water fountain demonstrations.

5. In many parts of the world irrigation is necessary for the successful cultivation of crops. Irrigation is a widely accepted practice in southern Alberta. Here is an example of a centre pivot irrigation system near Lethbridge. There are other types of irrigation systems such as wheel move, flood and drip type, all of which contribute to the production of better and higher yielding crops from irrigated lands.

6. Erosion of valuable soil and nutrients by water is very detrimental to the agricultural industry. Much valuable land is lost every year due to soil erosion by runoff. Without preventative measures, many fields can be ruined. If erosion goes out of control small rills can form into gullies and ditches, or a large canyon can result. The Grand Canyon resulted from water wearing away the land. The Badlands near Drumheller are another example of what can happen from water continuously eroding the land surface.

7. Uncontrolled water is one of nature's most destructive forces. The seasonal variations in flows of rivers in Alberta present water management problems. Without some form of flow regulation large volumes of water flow unused and in some cases cause flood and erosion damage. Floodplains of rivers are areas subject to occasional flooding. Aside from the more obvious damage which occurs during a flood, the flood waters carrying additional sediment frequently lead to problems for domestic water supply and fish life.

8. Water is a valuable resource for individuals, communities, industries, and agriculture. It is used extensively for a wide variety of purposes. Modern living standards place a high demand on the water resource. Domestic residential purposes in municipalities comprise a major portion of water use. After use, the water is usually returned in a modified form.

9. Water is also a key raw material in many industrial processes. Industries use water as an input for cooling, washing, generating steam and for other minor purposes. The availability of water is one factor that may influence the location of industries. Suncor's oil sand extraction plant uses large quantities of water.

10. The paper and allied products industry in the Province of Alberta is another main manufacturing water using industry. This slide shows the Town of Hinton and the St. Regis pulp and paper mill which use the Athabasca River as a source of water.

11. Water is one of the basic requirements for agricultural production. This sector uses large amounts of water for three main purposes: irrigation, stockwatering, and rural residential uses, of which irrigation is usually the largest component.

12. Water resources are dynamic in terms of location and use. The problem of not conserving or using water wisely is essentially a population problem. The intensity of water resource development and techniques employed for its conservation are very dependent upon man and overall population. Water conservation is a management device that may be integrated into plans for the wise use of this limited resource. We as individuals can help to check pollution and use of water. If we do not use it carefully we will not have any water of good quality or quantity in the future.

1985 CONSERVATION CAMP DELEGATES

ALBERTA		
Lethbridge Region		
Stephanie Haupt	General Delivery, Medicine Hat T1A 7E4	527-0535
Warren Johnson	Scandia T0J 2Z0	362-3917
Tannis MacFarlane	Box 1323, Medicine Hat T1A 7N1	527-0412
Airdrie Region		
Cheryl Goodwin	R.R.#2, Sundre T0M 1X0	638-3215
Leanne Griffith	R.R.#2, Balzac T0M 0E0	226-0555
Darcy Jackson	Lyalta T0J 1Y0	285-9077
Anita Malyk	Site 1, Box 7, R.R.#1, Airdrie T0M 0B0	948-5323
Gary Thomas Myers	R.R.#1, Box 5, Site 7, Cochrane T0L 0W0	932-6762
Renee Salins	23 Summerfield Road, Airdrie T0M 0B0	948-4036
Rob Smith	R.R.#2, Olds T0M 1P0	556-2290
Stettler Region		
Kimberly Brennan	R.R.#1, Forestburg T0B 1N0	582-2243
Lorna Cousins	Box 28, Craigmyle T0J 0T0	364-2285
Craig Lyon	Box 218, Youngstown T0J 3P0	779-2192
Kevin McGillivray	Box 584, Provost T0B 3S0	753-6624
Rob Nichols	Box 267, Castor T0C 0X0	882-4036
Robbie Palmer	Forestburg T0B 1N0	582-2154
Rob Scheler	Forestburg T0B 1N0	582-2114
Neil Stringer	Sunnynook T0J 3J0	566-2232
Heather Tabor	Box 103, Delia T0J 0W0	364-2384
Tammie Van Tighem	General Delivery, Carstairs T0M 0N0	335-9898
Red Deer Region		
Scott Anderson	Kelsey T0B 2K0	375-2426
Grant Burns	R.R.#2, Bluffton T0C 0M0	843-6041
Stacey Johnson	Box 200, Rimbey T0C 2J0	843-6066
Teresa Johnson	R.R.#3, Wetaskiwin T9A 1X1	352-4954
Karen Simpson	R.R.#1, Bentley T0C 0J0	843-6251
Randy Stretch	R.R.#1, Ponoka T0C 2H0	783-2383
Barrhead Region		
Julie Cook	8022 100th Ave, Edmonton T8L 3K3	998-0539
Shauna Crozier	Box D, R.R.#2, St. Alberta T8N 1M9	973-3110
Allan Maksymec	R.R.#1, Leduc T9E 2X1	986-3701
Jason Sawchuk	Box 1616, Athabasca T0G 0B0	675-9144
Lisa Szybunka	Box 351, Sangudo T0E 2A0	785-2657
Timothy Wegner	R.R.#1, Thorsby T0C 2P0	789-2213
Kerri-Lyn Werenka	Box 127, Sangudo T0E 2A0	785-2176
Lorne Witter	Box 260, Legal T0G 1L0	961-3864
Vermilion Region		
Rhonda Cyr	Box 157, Innisfree T0B 2G0	592-2317
Dale Emery	Box 223, Grande Centre T0A 1T0	594-2172
Dallas Fraser	Box 1458, St. Paul T0A 3A0	645-2739
Hope Gaugler	Hoselaw, T0A 1Y0	826-5858
Michelle Gottenbos	St. Brides T0A 2Y0	645-2225
Cameron Horner	Box 1480, St. Paul T0A 3A0	645-5106
Cameron Johnson	Box 766, Grand Centre T0A 1T0	639-2115
Alain Joly	Box 1905, St. Paul T0A 3A0	645-2204
Glen King	Wainwright T0B 4P0	842-4990
Donnie Lysons	Box 1760, Vermilion T0B 4M0	853-2490
Cathy McGrath	R.R.#3, Vermilion T0B 4M0	853-2529
Kalvin Ott	Box 1287, Wainwright T0B 4P0	842-2373
Phyllis Tod	Mannville T0B 2W0	763-2129

Michael Wasylik	Box 2022, Vermilion T0B 4M0	853-2616
Darryl Waterfield	Box 68, Islay T0B 2J0	744-2109
Nicole Wince	Box 645, Two Hills T0B 4K0	768-2213
Laurie Zayac	Derwent T0B 1C0	741-2222
Grant Zellweger	La Corey T0A 2E0	826-5805
Peace Region		
Greg Alexander	Box 85, Berwyn T0H 0E0	338-2209
Leslie Bak	Box 1152, Grande Prairie T8V 4B6	567-2137
Thora Baker	Box 424, Hythe T0H 2C0	356-2432
Trevor Binks	R.R.#1, Grande Prairie T8V 2Z8	532-6220
Cathy Dickson	Grimshaw T0H 1W0	332-4815
Patricia Fraser	R.R.#2, Sexsmith T0H 3C0	568-2129
Karen Hogg	R.R.#1, Wembley T0H 3S0	766-2738
Lisa MacAlister	Box 205, Wembley T0H 3S0	766-2461
Karen Sande	Box 907, Beaverlodge T0H 0C0	354-8610
Sherri Lynne Stewart	Box 296, Grimshaw T0H 1W0	332-4959

RETURN CAMPERS

Dillis Soetaert	R.R.#1, St. Albert T8N 1M8	
Paul Bland	Box 19, Site 3, R.R.#1, Strathmore T0J 3H0	

MONTANA

Eric Jones	Box 19, Pinecrest, Clancy 59634	933-5656
Barbie Kologi	1265 Washington Ave, Havre 59501	265-9094
Laura Larson	Simpson Rte, Box 81A, Havre 59501	265-5626
Rebecca Ann McClain	Box 547, Philipsburg 59858	859-3359

SASKATCHEWAN

Wayne Ferguist	Box 34, Pennant S0N 1X0	626-3776
Kathy-Jo Homquist	Box 29, Kiniskino S0J 1H0	864-3393
Greg Milman	Box 12, Maymont S0M 7T0	389-4312

1984 CONSERVATION CAMP DELEGATES

ALBERTA

Lethbridge Region		
Harry Bassett	Box 53, Medicine Hat T1A 7E5	832-2335
Jayson Meyers	Box 1199, Coaldale T0K 0L0	345-4294
Carrie Schank	25 Rossland Way SE, Med. Hat. T1B 1Z7	526-1163
Andy Zoeteman	Box 1089, Fort Macleod T0L 0Z0	553-2168
Airdrie Region		
Paul Bland	Box 19, Site 3, R.R.#1,Strathmore T0J3H0	934-3012
Darcy Craig	R.R.#1, Olds T0M 1P0	224-2989
Gerry Isley	Box 53, Langdon T0J 1X0	936-5547
Jim Scott	R.R.#2, Sundre	
Kenneth Teuling	Bowden	224-3885
Mary Teuling	Bowden	224-3885
Stettler Region		
Lyanne Forrest	R.R.#3, Coronation T0C 1C0	575-2271
Darcy Forrester	Box 40, Altario T0C 0E0	552-2240
Michael Melin	Czar T0B 0Z0	857-2362
Michelle Muyres	R.R.#1, Forestburg T0B 1N0	582-2205
Teresa Schroeder	R.R.#3, Coronation T0C 1C0	578-2264
Troy Southoff	Box 90, Czar T0B 1Z0	856-2228
Janice Woody	Box 25, Coronation T0C 1C0	578-2027
Red Deer Region		
Kristina Anderson	4113 38 Ave, Red Deer T4N 2T8	347-2591
Mark Fisher	General Delivery, Rosaling T0B 3Y0	375-2378
Ruth Gibson	Box 425, Holden T0B 2C0	688-2112
Michelle Kuzma	Box 785, St. Paul T0A 3A0	688-2154
Kelli McKibbon	R.R.#2, Holden T0B 2C0	688-2112
Scott Millar	R.R.#2, Gwynne T0C 1L0	352-3232
Owen Stobbe	R.R.#2, Millet T0C 1Z0	387-4390
Kent Stuehmer	R.R.#2, Millet T0C 1Z0	387-4450
Ann Marie Trenson	Box 421, Rimbey T0C 2J0	843-6778
Barrhead Region		
Dion Barry	Box 1342, Athabasca T0G 0B0	675-4764
Annette Boelman	Box 53, Pibroch T0G 1V0	349-2386
Michael Borys	R.R.#1, Leduc T9E 2X1	987-3221
Richard Cyr	Box 540, Legal T0G 1L0	961-3041
Nicola Kapicki	R.R.#1, Gibbons T0A 1N0	942-4249
Tammy Kapicki	R.R.#1, Gibbons T0A 1N0	942-4249
Thomas MacArthur	53321 Rge Rd 222, Ardrossan T0B 0E0	922-3607
Grant Mattson	Box 14, Mayerthorpe T0E 1N0	786-4731
Jackie Ofner	R.R.#2, Site 2, Box 1, St. Albert T8N1M9	973-6343
Richard Patriquin	R.R.#1, Westlock T0G 2L0	349-4034
Clifford Schwartz	Box 1166, Drayton Valley T0E 0M0	542-2271
Daniel Sequin	R.R.#1, Westlock T0G 2L0	349-5398
Dillis Soetaert	R.R.#1, St. Albert T8N 1M8	459-3090
Jerry Tuttle	Box 254, Evansburg T0E 0T0	727-3744
Karen Wozny	R.R.#8, Edmonton T5L 4H8	456-1920
Vermilion Region		
Tracy Dewart	Box 59, Bruce T0C 0R0	688-2247
Tanya Fontaine	Box 1217, St. Paul T0A 3A0	645-2507
Patricia Giffin	Box 1831, Vegreville T0B 4L0	632-7166
Sheryl Hatch	Box 32, Wandering River T0A 3M0	771-2345
Selene Homeniuk	R.R.#1, Willingdon T0B 4R0	367-2526
Aline Jubinville	Box 931, St. Paul T0A 3A0	645-4691

Tracy Kutash	Box 292, St. Paul T0A 3A0	645-3476
Shane Lauzon	Bonnyville, T0A 0L0	826-5728
Dennis Lysons	R.R.#3, Vermilion T0B 4M0	853-2490
Russell Paranich	Box 1285, Vegreville T0B 4L0	632-7184
Billy Pawluk	Mundare T0B 3H0	932-7116
Paula Premak	Box 2768, St. Paul T0A 3A0	645-3145
Jennifer Shandro	Box 300, Willingdon T0B 4R0	367-2483
Jewell Shandro	Box 300, Willingdon T0B 4R0	367-2483
Colleen Wengzynowski	Box 814, St. Paul T0A 3A0	645-2748
Loren Yaremchuk	Box 293, Myrnam T0B 3K0	366-3986
Tracy Yettaw	Box 917, St. Paul T0A 3A0	645-2291
Peace Region		
Christopher Bogner	Box 236, Berwyn T0H 0E0	338-2126
RETURN CAMPERS		
Greg Croten	Box 234, Barons T0J 0J0	
Tracy Pfannmuller	Box 94, Mayerthorpe T0E 1N0	
MONTANA		
Chris Ostberg	Box 144, R.R.#1, Fairfield 59436	
Paula Zuhoski	Box 354, Belt 59717	
SASKATCHEWAN		
Deanna Dozorec	Box 34, Wroxton S0A 4S0	
Shaun Janiskevitch	Box 337, Balcares S0G 0C0	
Roxi Smysniuk	Box 2367, Nipawin S0E 1E0	

1983 CONSERVATION CAMP DELEGATES

ALBERTA		
Lethbridge Region		
Brian Bratt	Box 692, Bow Island T0K 0G0	545-2631
Susan Kraft	Box 582, Etzikom T0K 0W0	666-2119
Greg Groten	Box 234, Brooks T0J 0J0	757-2409
Robert Groten	Box 234, Brooks T0J 0J0	757-2409
Alicia Schmid	Box 45, Warner T0K 2L0	642-3790
Airdrie Region		
Shane Bateman	R.R.#2, Calgary T2P 2G5	932-5428
Susan Brooks	Box 212, Blackie T0L 0J0	684-3753
Kevin Ellis	Standard T0J 3G0	644-2147
Tracey Munro	Site 1, Box 6, R.R.#1, Calgary T2P 2G4	242-9258
Karen Teskey	Box 15, Site 3, R.R.#8, Calgary T2P 2T9	931-3448
Stettler Region		
Allen Gamroth	Galahad T0B 1R0	583-2222
Darren Shaffner	Box 518, Castor T0C 0X0	882-2215
Red Deer Region		
Robin Burns	R.R.#2, Bluffton T0C 0M0	843-6041
Brett Bonde	R.R.#3, Rocky Mountain House T0M 1T0	845-6894
Doug Hovde	R.R.#1, Camrose T4V 2M9	672-6638
Rudy Lowe	Box 97, Buck Lake T0G 0T0	682-2171
Mark Pederson	R.R.#1, Site 2, Box 6, Camrose T4V 2M9	672-7214
Theresa Vincent	Pine Lake T0M 1S0	886-4857
Barrhead Region		
Lori Galloway	R.R.#1, Fort Saskatchewan T8L 2N7	998-2720
Dawn Hopkin	R.R.#1, Fort Saskatchewan T8L 2N7	998-3160
Corrine Koehll	Box 31, Evansburg T0E 0T0	727-2417
Arliss Kootnay	R.R.#1, Cherhill T0E 0J0	785-2751
Mark McRorie	Box 58, Jarvie T0G 1H0	954-3943
Kary Meger	Box 248, Seba Beach T0E 2B0	797-2104
Leslie Mitchell	R.R.#4, Edmonton T5E 5S7	973-5354
Valerie Noskye	Box 725, Barrhead T0G 0E0	674-5498
Robert Page	R.R.#1, Pickardville T0G 1W0	349-2656
Tracy Pfannmuller	Box 94, Mayerthorpe T0E 1N0	786-4608
Evlyn Romanowski	R.R.#4, Edmonton T5E 5S7	921-2359
James Schwindt	Box 838, Spruce Grove T0E 2G0	962-3316
Harvey Wright	R.R.#1, Barrhead, T0G 0E0	674-5498
Vermilion Region		
Faith Gaugler	Hoselaw T0A 1Y0	826-5858
Patrick Kelita	Box 397, Andrew T0B 0C0	365-2304
Ellen McGrath	R.R.#3, Vermilion T0B 4M0	853-2529
Devan Noult	Box 1297, Grande Centre T0A 1T0	594-2053
Lori Ruud	R.R.#3, Vermilion T0B 4M0	853-2436
Roxanne Ruud	R.R.#3, Vermilion T0B 4M0	853-2436
Dale Steele	R.R.#3, Vermilion T0B 4M0	853-2426
Peace Region		
Darrol Hurley	Box 741, Beaverlodge T0H 0C0	354-8520
Lisa Lieverse	Box 736, Beaverlodge T0H 0C0	354-2783

RETURN CAMPERS		
Earl Greenhough	R.R.#1, Warburg	
Lena Congdon	Box 54, Heisler	
MONTANA		
Sheryl Michel	Box 278, Dutton 59433	627-2336
Jan Rowland	R.R.#6, Box 1100, Townsent	266-3146
Wade Martin	Box 9, Hall	288-3347
Barb Steinruber	Box 65, Willow Creek 59760	285-6920
SASKATCHEWAN		
Lisa Williamson	Box 547, Indian Head S0C 2K0	695-2024
Graig Sorenson	Box 310, Ogena S0C 1Y0	459-2670
Lillian Ruest	Box 55, Admiral S0N 0B0	297-3527
JAPAN		
Takashi Hirane	c/o Box 234, Brooks T0J 0J0	757-2409

1982 CONSERVATION CAMP DELEGATES

ALBERTA

Eldon Akitt	Box 126 Carmangay
Karen Catt	Box 981, High Level
Scott Clark	Boyle
Lena Congdon	Box 54, Heisler
Helen Davidson	Alliance
John Day	R.R.#1, Legal
Robin Differenz	Box 477, Thorhild
Pamela Dixon	Box 100, Onoway
Joanne Dykstra	Box 1476, Ponoka
David B. Ellis	Box 117, Standard
Cathy Fallows	1820 24 St S, Lethbridge
Rhonda Fletcher	Box 61, Purple Springs
Angela Froese	R.R.#2, Morinville
Sharon Gafka	Box 897, Vegreville
Gerard A. Gahle	Box 503, Daysland
Cameron T. Gardner	R.R.#1, Nanton
Kimberly Gerlitz	Box 777, Beaverlodge
Earl Greenhough	R.R.#1, Warburg
Hilary Hahn	Box 53, Cremona
Clayton Hawrelak	Box 115, Willingdon
Curtis Henkelman	R.R.#1, Leduc
Kevin Kerr	R.R.#2, High River
Erik Klugkist	R.R.#1, Site 3, Box 7, Condor
Lyanne Klutz	Box 145, Daysland
Wilbur Kootenay	R.R.#1, Cherhill
Harvey Kosheiff	Box 82, Fairview
Wendy Kramer	Box 26, Bow Island
Joe Kubin	Box 1018, Vergreville
Tina Lauzon	La Covey
Tanya Lawrence	Box 521, Pine Lake
Jeff MacFarlane	Box 1323, Medicine Hat
Judy Maciborski	R.R.#1, Winfield
Malcolm Macdougall	Box 220, Champion
Kathy McNary	R.R.#1, Bittern Lake
Ardis Milne	Box 1209, Fairview
Shelley Murdoch	Box 88, Crossfield
Harold Nicolay	R.R.#1, Alhambra
Charlene Nobert	Box 1980, Strathmore
Tambelyn Palmer	Box 443, Two Hills
Andre Patriquin	R.R.#1, Westlock
Joel Pederson	R.R.#1, Camrose
Susan Penno	Box 503, Grimshaw
Patricia Quinton	Box 523, Gibbons
Beverly Sawyer	Pine Lake
Caroline Schwindt	Box 722, Spruce Grove
Scott Severtson	R.R.#3, Innisfail
Delin Sheehan	R.R.#2, Carstairs
Lisa-Marie Shuttleworth	Rolling Hills
Greg Skriver	Tilley
Gina Maire Spicer	Box 34, Mossleigh
Ron Strandquist	R.R.#1, Halkirk
Mark Sugimoto	2713 22 Ave S, Lethbridge

(1982 Conservation Camp Delegates Contd.)

Sandra Thring	Box 141, Cremona
Shelley Werenka	Box 127, Sangudo
Daryl A. Waterfield	Box 68, Islay
Angie Willcock	R.R.#6, Calgary
Darren Yasheyko	Box 172, Myrnam
Phillip Zadnik	Box 33, Taber
Valerie Zayak	Derwent

RETURN CAMPERS

June Tchir	Box 65, Spedden
Greg Urichuk	R.R.#1, Willingdon

MONTANA

Cathy Binando	1208 South 64 West, Billings 59106
Kristi Dolezilek	Route 1, Box 22, Townsend 59644
Ruth Harding	Box 157, Philipsburg 59858
Vicki Jo Weaver	Star Route Box 981, Clinton 59825

SASKATCHEWAN

Wilma Harris	Box 192, St. Walburg S0M 2J0
Ian McKenzie	Lashburn S0M 1H0

1981 CONSERVATION CAMP DELEGATES

ALBERTA

Kevin Airth	Debolt T0H 1B0
Greg Braat	Box 692, Bow Island T0K 0G0
Danny Brown	R.R.#2, Tofield T0B 4J0
Michelle Budzich	R.R.#1, Busby T0G 0H0
Paul Chamberland	Box 232, St. Paul T0A 3A0
Doug Clemens	Mossleigh T0L 1P0
Warren Coates	R.R.#1, Willingdon T0B 4R0
Chris de Bruyn	R.R.#1, Rocky Mountain House T0M 1T0
Teresa de Milliano	R.R.#2, Millet T0C 1Z0
Leanne Dykstra	Box 1476, Ponoka T0C 2H0
Ken Forbes	Peers T0E 1W0
Jean Fortier	R.R.#1, Vimy T0G 0P0
Pam Gabbey	R.R.#2, St. Albert T8W 1M9
Michael Gibson	General Delivery, Cooking Lake T0B 3N0
Kevin Glebe	R.R.#1, Pickardville T0G 1P0
Penny Holthe	Box 253, Turin T0K 2H0
Shelley Horner	Box 1480, St. Paul T0A 3A0
Heather Jackson	Box 2, Site 7, R.R.#8, Calgary T2P 2G4
Iden Johnson	Box 766, Grand Centre T0A 1T0
Pamela Johnson	Box 99, Mirror T0B 3C0
Larry King	R.R.#1, Peers T0E 1W0
Audrey Klassen	Box 389, Debolt T0H 1B0
Janet Kotowich	Box 83, St. Paul T0A 3A0
Marina Lieverse	Box 736, Beaverlodge T0H 0C0
Debbie Lysons	R.R.#3, Vermilion T0B 4M0
Jean-Marie Lusson	Box 148, Clyde T0G 0P0
Jeff MacFarlane	Box 1323, Medicine Hat T1A 7N1
Steven Merchant	Keoma T0M 1G0
Colleen Munro	Site 1, Box 6, R.R.#1, Calgary T2P 2G4
Darrel Osborn	Box 2112, Edson T0E 2G0
Joni Randall	Keoma T0M 1G0
Effie Romaniuk	Box 211, Willingdon T0B 4R0
John Rusin	Box 157, Evansburg T0E 0T0
Charlotte Samis	R.R.#1, Bon Accord T0A 0K0
Susan Schile	Box 133, Foremost T0K 0X0
Darlene Semeniuk	Box 144, Myrnam T0B 3K0
Perry Sikstrom	R.R.#1, Winterburn T0E 1N0
Gary Smid	R.R.#3, Rocky Mountain House T0M 1T0
JoDee Smith	R.R.#2, Millet T0C 1Z0
Doug Standing	Box 643, Hanna T0G 1P0
John Taylor	R.R.#1, Chauvin T0B 0V0
June Tchir	Box 65, Spedden T0A 3E0
Lyle Tilby	R.R.#1, Peers T0E 1W0
Ron Tilby	R.R.#1, Peers T0E 1W0
Luc Trenson	Box 421, Rimbey T0C 2J0
Rodney Turner	R.R.#4, Eckville T0M 0Y0
Greg Urichuk	R.R.#1, Willingdon T0B 4R0
John Van Tryp	Box 101, Burdett T0K 0J0
Alanna Vath	Box 9, Site 9, R.R.#4, Edmonton T5E 5S7
Byron Vogstad	Box 509, East Coulee T0J 1B0
Lisa Wagner	R.R.#1, Stony Plain T0E 0P0
Maureen Walker	R.R.#1, Wetaskiwin T9A 1W8

(1981 Conservation Camp Delegates Contd.)

Darryl Walton	R.R.#1, Tees T0C 2N0
Bryon Walters	Box 335, Vermilion T0B 4M0
Keith Wyllie	Box 567, Vegreville T0B 4L0
Cynthia Yaremchuk	Box 293, Myrnam T0B 3K0

RETURN CAMPERS

Norm Ellis	Box 117, Standard
Mona Oatway	R.R.#1, Grande Prairie

SASKATCHEWAN

Pati Fowler	Box 371, Weyburn S4H 2K3

MONTANA

Dan Folske - Chaperone
Janice Carpenter
Laura Lake
Linda Montgomery
Pete Rising

ONTARIO

Michelle Erbertseder	Cambridge

1980 CONSERVATION CAMP DELEGATES

ALBERTA

Andrew Beniuk	Box 121, Evansburg
Leanne Libby	Box 1502, Westlock
Derek Brewin	Box 50, Purple Springs
Matt Burlet	Cherhill
Stanley Burris	R.R.#1, Winfield
Dwaine Clarke	Box 652, Spirit River
Carolyn Dearing	R.R.#2, Westerose
Frances deMilliano	R.R.#2, Millet
Bonnie Dowell	Box 298, Carstairs
Norm Ellis	Box 117, Standard
Richard Enns	Box 246, Fort Vermilion
Jojo Escalona	Box 543, Thorhild
Susan French	R.R.#1, Westlock
Dennis Gingras	Lac La Biche
Barry Halwa	R.R.#3, South Edmonton
Lynn Heath	Box 282, Grande Prairie
Karen Hebson	R.R.#2, Okotoks
Linda Hodge	Box 937, Westlock
Karen Jahns	R.R.#1, Forestburg
Jan Caroline Jamison	Box 308, Vegreville
Donna Lynn Knight	R.R.#7, Calgary
Paul Kotowich	Box 83, St. Paul
Darcy Krysta	Derwent
Glen Lewiski	Lac La Biche
Anne Lieverse	Box 736, Beaverlodge
Joanne Loesch	Heisler
Joan MacArthur	R.R.#1, Fairview
Danny Majeau	Riviere Qui Barre
Mary Malyk	R.R.#1, Airdrie
Mark Millang	R.R.#2, Camrose
Cathy Minar	Bindloss
Donna Mykyte	Box 168, Thorhild
Lisa Nagge	Box 1089, Thorhild
Colin Nowicki	Box 371, Lac La Biche
Mona Oatway	R.R.#1, Grande Prairie
Tammy Parsons	Box 44, Abee
Mary Jean Pauka	Cranford
Dianna Pelech	Hamlin
Rhonda Polukoshko	Box 448, Hines Creek
Ted Prodniuk	Box 89, Thorhild
Kathy Reinders	Box 114, Deadwood
Anne-Marie Roska	R.R.#1, Vimy
Richard Rurka	Box 95, Vilna
Shirley Rusin	Box 157, Evansburg
Lyall Semeniuk	Box 144, Myrnam
Corine Soetaert	R.R.#1, St. Albert
Neil Stang	Rosalind
Geoffrey Tatlow	R.R.#4, Ponoka
Casey Tchir	Box 65, Spedden
Donald Wagner	R.R.#1, Thorsby
Dale Wenzel	R.R.#6, Site 7, Box 14, Edmonton
Gwen Wolters	Box 335, Vermilion

RETURN CAMPERS	
Paul Froese	P.O. Box 205, St. Albert
Janis Kendrick	R.R.#1, Pickardville
MONTANA	
David Dolzelik	Box 27, Route 1, Townsend
Lisa Norris	2005, 6th St SW, Great Falls
Michael Zuhoski	Box 354, Belt
SASKATCHEWAN	
David Lalach	Wynyard
Beverly Webster	St. Walbury

1979 CONSERVATION CAMP DELEGATES

ALBERTA

George Agrey	R.R.#1, Spirit River
Maureen Aley	Box 233, Wanham
Blanche Andrew	Box 224, Youngstown
Dave Berg	Box 238, Daysland
Bradley Binks	R.R.#1, Grande Prairie
Roger Bouw	Box 86, Bow Island
Brenda Brent	Box 69, Alberta Beach
Janice Chomlak	Beauvallon
Chris Cripps	R.R.#1, Westerose
Joseph Crooymans	Box 572, Box Island
Fawnna Dortch	Carnwood
Sandra Elliott	Dewberry
Paul Froese	P.O. Box 205, St. Albert
Rena Gordey	Box 1183, Peace River
Shelley Greaves	Box 205, Tomahawk
Sandra Hall	Box 326, Evansburg
William Hochhausen	Strome
Robert Holden	Box 536, Lamont
Clancy Holthe	Box 253, Turin
James Hormoth	Box 95, Iron Springs
Wendy Howe	Box 206, Stettler
Jim Johnson	Box 766, Grande Centre
Janis Kendrick	R.R.#1, Pickardville
Mike Kotelko	Box 57, Vegreville
Brian Lieverse	Box 736, Beaverlodge
Kevin Lovich	R.R.#1, Cherhill
Debbie Midtdal	R.R.#1, Westerose
Mari Nakamura	R.R.#1, Morinville
Brady Nordell	General Delivery, Peers
George Pluemeck	Box 76, Airdrie
Gisela Pluemeck	Box 76, Airdrie
Shelley Pruss	Box 90, St. Michael
Joyce Roberts	Box 624, Westlock
Steve Rodehutskors	R.R.#1, Strathmore
Helene Roy	Box 905, Edson
Randall Semeniuk	Myrnam
Kelley Schaffner	Box 516, Castor
Reginald Shandro	Box 300, Willingdon
Sandra Sheehan	R.R.#1, Site 2, St. Albert
Roxanne Shihinski	Box 26, Daysland
Willy Smith	R.R.#1, Westlock
Diane Snider	Box 207, Onoway
Beth Strong	R.R.#2, St. Albert
Margaret Teuling	Bowden
Valerian Urichuk	R.R.#1, Willingdon
Carla Wilson	Box 69, Nanton
Don Yanitski	Box 31, Myrnam
Candace Zayak	Derwent
Carol Zayak	Derwent
Bev Ziegler	Ponoka

RETURN CAMPERS

Greg Francis	R.R.#2, Ardrossan
Bette-Jean McElroy	Box 127, Hussar

1978 CONSERVATION CAMP DELEGATES

ALBERTA

James Antoniuk	Box 42, Two Hills
Maxine Kaye Balla	Iron River
Ray Binks	R.R.#1, Grande Prairie
Sandra Bourgeois	R.R.#1, Fort Saskatchewan
Debbie Campbell	Box 37, Trochu
Blain Cellars	R.R.#7, Calgary
Marilyn Craig	Box 243, Crossfield
James Dadensky	Box 475, Two Hills
Duane Dahl	Box 63, Red Willow
Branda Davies	Duffield
Casey Douglas	Box 98, Vulcan
Kim Dwernychuk	R.R.#2, Wembley
Charles Dykstra	Box 1476, Ponoka
Greg Francis	R.R.#2, Ardrossan
Gerard Gibeau	Box 3116, Cluny
Scott Hansen	Box 245, Onoway
Leslie Henderson	Carstairs
Ken Hetman	R.R.#2, Millet
Stephen Hormoth	Box 95, Iron Springs
Robert Hornstra	R.R.#1, Alhambra
Laurie James	R.R.#1, Okotoks
Darcy Jones	R.R.#3, High River
Kendall, Johnson	R.R.#2, Ryley
Murray Klutz	General Delivery, Daysland
Myrna Kleuyer	Box 1495, Ponoka
Connie Korpan	Box 895, Vegreville
Jocelyn Lehr	Box 124, Manyberries
Janice Lievers	Flatbush
Marianne Luchia	Box 68, Nobleford
Gisele Magnusson	R.R.#1, Fairview
York Malner	R.R.#1, Busby
Bruce Mattson	Box 28, Orion
Bette-Jean McElroy	Box 127, Hussar
Marion Miner	Box 194, Mayerthorpe
Kimberly Munteanu	Flatbush
Michelle Olson	Box 1078, Drumheller
Kevin Plain	Box 501, Westlock
Douglas Pockrant	R.R.#5, Wetaskiwin
Ray Radcliffe	Box 281, Stony Plain
Barbara Rains	Evansburg
Rhonda Richards	Box 572, Olds
Danny Schneider	Box 71, Bow Island
Patti Shandro	Box 300, Willingdon
Lorna Sinton	Box 428, Crossfield
Ellen Smith	R.R.#2, Duffield
Linda Soetaert	Riviere Qui Barre
Brent Steele	General Delivery, Wembley
Terrace Sutherland	Box 125, Wembley
Laura Symchuk	Box 2, R.R.#1, Spirit River
Rickie Teuling	Bowden
Cora Van Gyssel	R.R.#3, Ponoka
Dave Uchacz	R.R.#1, Morinville
Brad Vowk	Box 1383, Drayton Valley

(1978 Conservation Camp Delegates Contd.)

Irma Wadman	R.R.#1, Alhambra
Wendy Wobeser	R.R.#1, Lloydminster
Wendy Yasheyko	Box 308, Myrnam
Cindy Yasheyko	Box 208, Myrnam
Russel Zilinski	Box 89, Legal

RETURN CAMPERS

Helen Schwenk	Box 386, Coronation
David Bateman	R.R.#2, Wembley

CONSERVATION CAMP 1984

ENVIRONMENTAL HEARING

A. OBJECTIVES

The purpose of this exercise is:

1) To illustrate the integration of all parts of the environment.

2) To create an awareness of the complexity and difficulty of making real-life decisions concerning environmental use.

3) To utilize and apply information provided during this week to represent views held by various interest groups in our society.

Company: Shooting Star Recreational Developments

B. PROPOSAL (Application)

That Silver Creek Ranch headquarters, and all lands either owned or leased by that body (total 160 acres deeded, 240 acres lease) be developed as an intensive recreational area to serve the needs of residents of the district, as well as the ever expanding urban market in and around the major center of Calgary. This development would, over a twelve year period involving three phases of development, include:

Phase I - Development as Winter Recreation Area

a) Development of a ski-hill including rope tow and T-bar initially, with a Chalet to accommodate up to 300 enthusiasts on a daily basis.

b) Clearing of a cross country ski trail, basically to ring the outer perimeter of land in question with two trails traversing the land parcels, providing three possibilities as to trail distance.

c) Establishment of independent snowmobile trail systems.

d) Upgrading of road systems to include an all-weather road to the Silver Creek headquarters site.

e) Conversion of the Silver Creek H.Q. site to a restaurant capable of seating approximately 100 people.

Phase II - Summer Recreational Development

a) Dredging of the creek which runs adjacent to Silver Creek Ranch headquarters, including elimination of beaver dams, and eventual restocking of the creek with rainbow, and brook trout.

b) Multiple use of snowmobile trail routes in terms of all terrain motor vehicles, operating in the summer months.

c) Development of the land immediately west of the creek to include accommodation for 200 serviced camp stalls for rec. vehicles. Outdoor kitchen facilities to be included, and provision for a water source (drilled well).

d) Tennis courts to be constructed adjacent to camp site facilities.

e) Nine-hole pitch & putt golf course to be constructed in close proximity.

Phase III - To include intensive development of additional major facilities to accomodate not only recreational enthusiasts, but also the Convention trade on a year round basis.

a) Development of a hotel capable of accommodating 300 patrons overnight, with banquet facilities capable of handling 500 people. (This to replace Silver Creek Ranch headquarters, and to build on that site, also to include modern restaurant facilities capable of accomodating all patrons.)

b) Development of a multi-use recreational complex, including indoor swimming pool, eight sheets of ice for curling, skating rink, and raquetball courts (site to be determined after feasibility study complete).

c) Provision of on-site housing for pernament year round employees, associated with hotel, restaurant, recreational complexes, as well as General Manager of the site, and associated administrative personnel.

d) Upgrading of ski-hill site, including development of additional runs, inclusion of chair-life facility, and expansion of chalet areas to accomodate projected increase in use.

e) Lobbying of government to establish airport facilities in close proximity of Shooting Star Development.

f) Efforts to be made to procure additional lands surrounding original site to accomodate ever increasing recreational trade.

g) Co-ordination of retail stores, small businesses, wishing to locate in close proximity to hotel complex.

C. ROLES

1) Applicant Group (8 people) - Shooting Star Recreational Developments.

Duties

Responsible for setting up their own corporate structure. Individuals in the applicants group may act as major stockholders, support groups for preparation, technical advisors, or promotion and advertising people who may lobby other interest groups during the course of the program. All individuals should be involved in the original presentation or in rebuttals to concerned groups. Applicant must also:

- Formally identify themselves (by a sign)
- Provide a statement of expenditures for posting at the hearing
- Present their application in such a manner that all five conservation areas have been considered.
- Be prepared to offer rebuttals to concerned groups and answer questions posed by hearing participants.

2) Concerned Groups (Interveners) (6 people per group)

a) Duties

- To formally identify themselves (by a sign) for hearing
- To provide an accounting of expenditures at the beginning of their presentation
- To present a 5 minute submission to the Local Authorities Board
- To be actively involved in the question period
- May lobby other concerned groups whom they feel may support their cause, assist with finances, etc. Each group is responsible for making their own 5 minute presentation (ie). Two groups may not combine forces for one 5 minute submission.

b) List of Concerned Group

- Present owners and managers of Silver Creek Ranches Ltd.
- Concerned farmers and area residents
- Water Valley Chamber of Commerce
- STOP (an environmental group concerned with preservation of natural resources and effects of pollution).
- Big Wally Enterprises (a group of investors interested in establishing a recreational complex nine miles north of Shooting Star, commencing in 1985).
- Alberta Investors Syndicate (Major credit source for Shooting Star Recreational Developments)
- Alberta Government (Group to determine and represent views of Government departments who may have involvement in the project)
- Slash Ltd. (a company interested in harvesting timber resources of the area)
- Like It or Lump It Ltd. (a company interested in investigating coal resources of the area, with a view towards commercial marketing)
- Water Valley Fish and Game Association
- East Slopes Guides and Outfitters Association

D. OTHER ROLES

1) Local Authorities Board

a) Consists of the five resource Instructors. They are responsible for accepting the submissions from all interest groups, weighing materials presented, and making a final decision as to whether the project is acceptable in whole or in part after all of the presentations have been made.

b) By way of debriefing the exercise, explain reasoning behind their decision, and make general comments as to strengths and weaknesses of presentations.

c) Moderator
- Chairman of the session (Elton)
- To introduce groups and facilitate logical and orderly progression of the hearing.

d) Timekeeper

- To keep accurate time to eliminate the possibility of unfair advantage individual groups.

e) 4-H Staff
- To be available throughout the course of presentations
- To clarify and facilitate group discussions

f) Resource Staff
- Available in advisory capacity to groups during preparation time
- To answer specific technical questions groups may have

g) Junior Staff
- The Junior staff may participate as a member of a concerned group but may not be a part of the Applicant group.
- The Junior staff have prior experience - use it!!

TIME TABLE - (Friday)

1:00 p.m.	- Introduction by Moderator
1:05 p.m.	- Applicants presentation
1:15 p.m.	- Question period
1:20 p.m.	- Concerned groups (interveners) presentation. Each of the 10 concerned groups will be allowed 5 minutes to present their views on the proposal. After each of the concerned groups presentations, the applicant group will have an optional 2 minute for rebuttal. If the applicant group presents a rebuttal, a maximum of three questions will be allowed from hearing participants
2:30 p.m.	- Break
2:45 p.m.	- Summary
3:15	- Debriefing by the Local Authorities Board

*Note: Local Authorities Board may pose questions following any presentation to provide clarification, more detail, etc.

E. MONETARY RESOURCES

1) Purposes

a) To add realism to all efforts and endeavers leading up to the Environmental Hearing Presentations.
b) To provide a media facility through which groups can publicize their views.
c) To provide professional advisory services to interest groups.

2) Implementation

a) Initial monetary resources will be granted to applicant and concerned groups on a realistic basis, according to the typical financial situation of such a group. eg. Big Wally Enterprises would have more money to work with than farmers & area would.
b) Applicant and concerned groups can place advertisements in the camp newspaper to promote their viewpoint.
   - $50./entry, with maximum size of $\frac{1}{4}$ page.
c) Resource staff and present camp owner may be consulted for technical information or advice for a negotiable fee.
   - As services of government agencies are normally available to all citizens, strictly background information is available to groups free of charge (ie.). Only detailed analysis, or advice given which provides conclusions or recommendations for action will be charged as consultants fees.
   - 4-H Staff and Jr. Staff will be available to answer questions about implementation of the Hearing.

MONETARY RESOURCES AVAILABLE TO GROUPS

A. Guidelines

(1) Groups must negotiate with consultants (resource instructors and camp owner) regarding fees for services.

(2) Groups should attempt to stay within budgeted resources available to their group. (In some cases individuals within a group must first agree to most feasible use of funds.)

(3) Groups are responsible for keeping records of all transactions and posting at beginning of their presentation.

B. Monetary Resources Available to Groups

Shooting Star - $250,000.00
Owners & Managers Silver Creek - $2,000.00
Concerned Farmers and Area Residents - $200/person
Water Valley Chamber of Commerce - $500/business
Water Valley Fish & Game - $750.00
STOP - $5,000.00
East Slopes Guides and Outfitters - $1,000.00
Alberta Investors Syndicate - $20,000.00
Alberta Government - Committment from Heritage Trust Fund to fully endorse Government's position once clearly established
Big Wally - $100,000.00
Slash Ltd. - $50,000.00
Like It or Lump It - $20,000.00